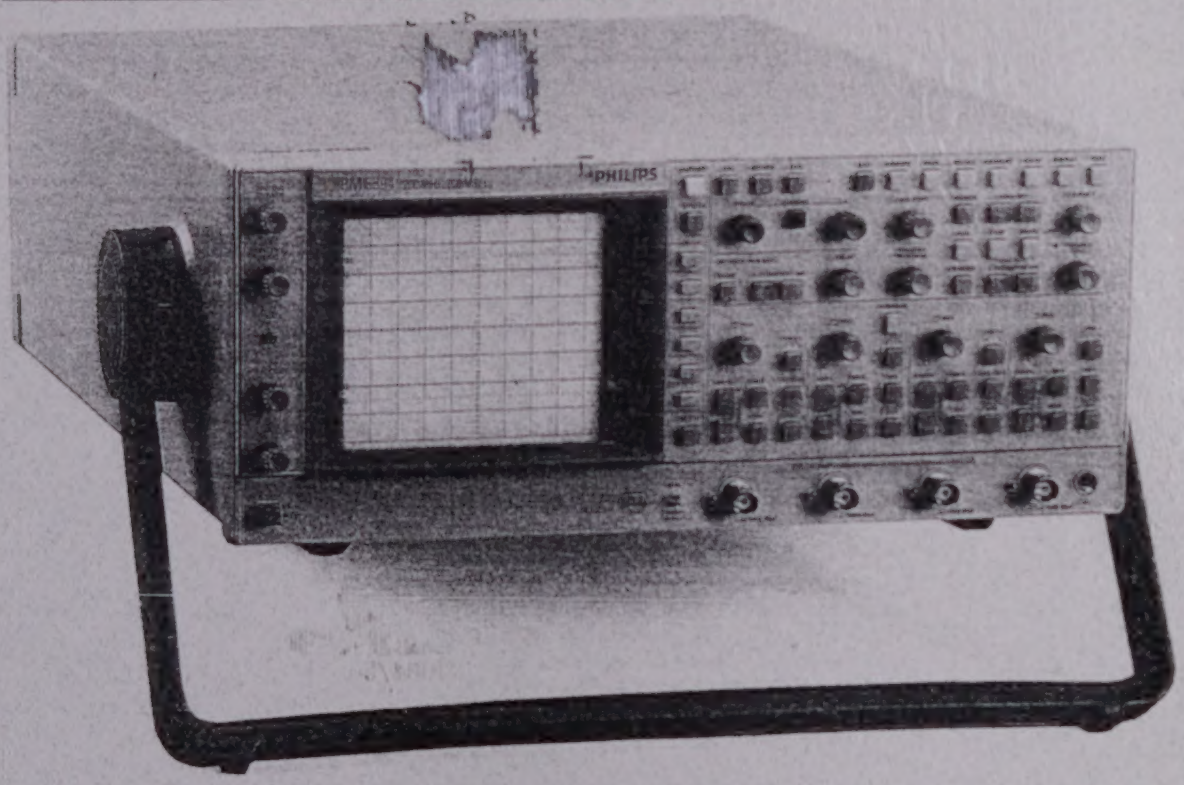
PM3382 - PM3384 100 MHz 200 MS/s DSO
PM3392 - PM3394 200 MHz 200 MS/s DSO

Service Manual

4822 872 05356
930301



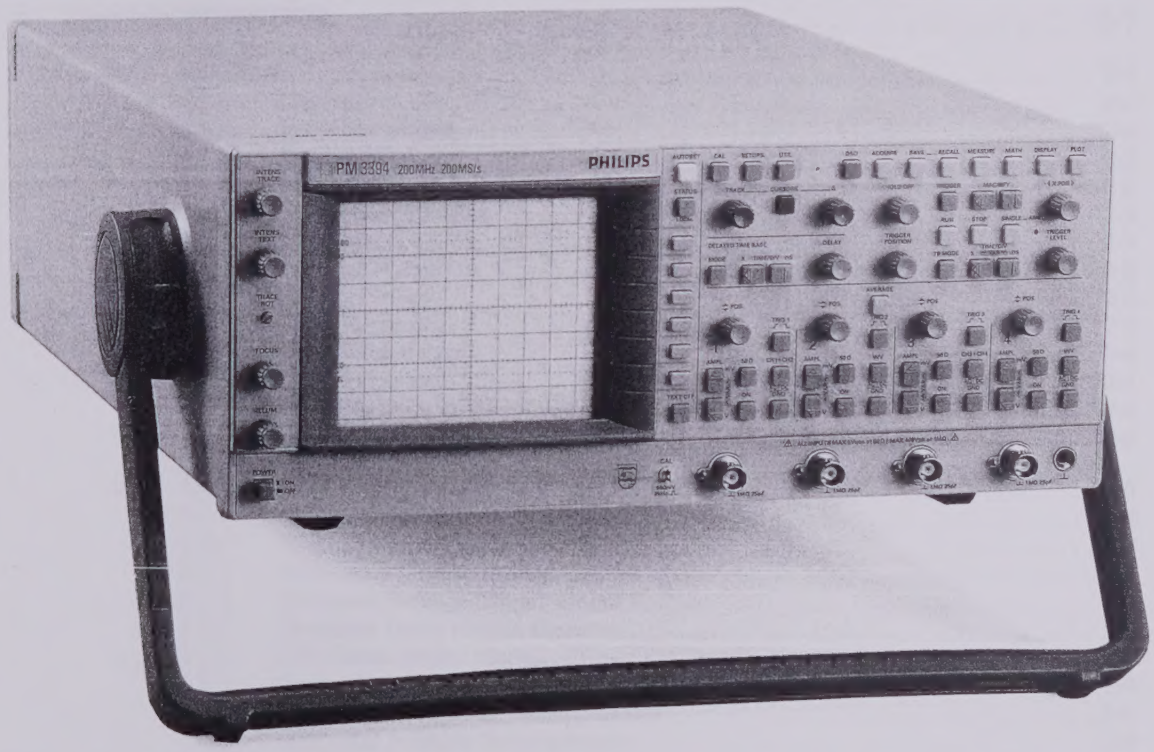
Warning: These servicing instructions are for use by qualified personnel only. To reduce the risc of electric shock do not perform any servicing other than that contained in the operating instructions unless you are fully qualified to do so.

PHILIPS

PM3382 - PM3384 100 MHz 200 MS/s DSO
PM3392 - PM3394 200 MHz 200 MS/s DSO

Service Manual

4822 872 05356
930301



Warning: These servicing instructions are for use by qualified personnel only. To reduce the risc of electric shock do not perform any servicing other than that contained in the operating instructions unless you are fully qualified to do so.

PHILIPS

IMPORTANT

In correspondence concerning this instrument please give the model number and serial number as located on the type plate on the rear of the instrument.

For your reference:

Model number: PM 30XX/YY
Serial number: DM .

Note: The design of this instrument is subject to continuous development and improvement. Consequently, this instrument may incorporate minor changes in detail from the information provided in this manual.

© PHILIPS ELECTRONICS N.V., 1993
All rights reserved. No part of this publication may be reproduced by any means or in any form without written permission of the copyright owner.

Printed in The Netherlands

TABLE OF CONTENTS

Page

1. SAFETY INSTRUCTIONS 1-1

1.1 INTRODUCTION 1-1

1.2 SAFETY PRECAUTIONS 1-1

1.3 CAUTION AND WARNING STATEMENTS 1-1

1.4 SYMBOLS 1-1

1.5 IMPAIRED SAFETY-PROTECTION 1-2

1.6 GENERAL SAFETY INFORMATION 1-2

2 CHARACTERISTICS 2-1

2.1 VERTICAL 2-2
- 2.1.1 Channels 2-2
- 2.1.2 Deflection Modes 2-2
- 2.1.3 Bandwidth 2-2
- 2.1.4 Attenuator 2-2
- 2.1.5 Input Characteristics 2-3
- 2.1.6 Coupling 2-3
- 2.1.7 Dynamic Range 2-3
- 2.1.8 Position Range 2-3
- 2.1.9 Trace Separation 2-3
- 2.1.10 Input Voltage Limits 2-4
- 2.1.11 Step Response 2-4
- 2.1.12 Signal Delay 2-4
- 2.1.13 Vertical Accuracies 2-5

2.2 TIMEBASE 2-6
- 2.2.1 Timebase Modes 2-6
- 2.2.2 Timebase Settings (Analog mode) 2-6
- 2.2.3 DTB Delay (Analog mode) 2-6
- 2.2.4 Timebase Settings (Digital Mode) 2-7
- 2.2.5 Timebase Delay (Digital Mode) 2-7
- 2.2.6 DTB Delay (Digital Mode) 2-8
- 2.2.7 Analog Timebase Accuracies 2-8
- 2.2.8 Delaytime Accuracies (Analog Mode) 2-8
- 2.2.9 DTB Jitter In Starts (Analog Mode) 2-8
- 2.2.10 Timebase Accuracies (Digital Mode) 2-8
- 2.2.11 DTB Jitter In Starts (Digital Mode) 2-8
- 2.2.12 External Horizontal Deflection 2-9

2.3 TRIGGERING 2-9
- 2.3.1 Source 2-9
- 2.3.2 Modes 2-9
- 2.3.3 TV Systems 2-9
- 2.3.4 Coupling 2-10
- 2.3.5 Sensitivity 2-10
- 2.3.6 Slope 2-11
- 2.3.7 Level 2-11
- 2.3.8 Logic Triggering Timing (Digital Mode) 2-12
- 2.3.9 Trigger Accuracies 2-12

2.4 EVENT COUNTER 2-13

2.5 HOLD-OFF 2-13

2.6 PROCESSING 2-14
2.6.1 Preprocessing 2-14
2.6.2 Register Processing (Digital Mode) 2-14

2.7 TRACE MEASUREMENTS (DIGITAL MODE) 2-15

2.8 CURSORS 2-15
2.8.1 Cursor Control 2-15
2.8.2 Cursor Readouts 2-16
2.8.3 Cursor Accuracies (Analog Mode) 2-16
2.8.4 Cursor Accuracies (Digital Mode) 2-16

2.9 DIGITAL ACQUISITION 2-17
2.9.1 Modes 2-17
2.9.2 Sample Rate 2-17
2.9.3 Multiplexed Channels 2-17
2.9.4 Trace Memory 2-17
2.9.5 Acquisition Time 2-18
2.9.6 Resolution 2-18
2.9.7 Registers 2-18
2.9.8 Register Manipulations 2-18
2.9.9 Digital Acquisition Accuracies 2-19

2.10 FRONT PANEL MEMORY 2-19

2.11 BLANKING OR Z-AXIS 2-19

2.12 DISPLAY 2-19
2.12.1 CRT 2-19
2.12.2 Modes 2-19
2.12.3 Vertical Display Manipulations (Digital Mode) 2-20
2.12.4 Horizontal Display Manipulations (Digital Mode) 2-20

2.13 EXTERNAL INTERFACE 2-20
2.13.1 Calibrator 2-20
2.13.2 Standard External Interface 2-21
2.13.3 Optional External Interface 2-22
2.13.4 Printers and Plotters support 2-22

2.14 AUTO SET CALIBRATION 2-22
2.13.1 Auto Set 2-22
2.14.2 Calibration 2-22

2.15 POWER SUPPLY & BATTERY BACKUP 2-23
2.15.1 Power Supply 2-23
2.15.2 Battery Backup 2-23

2.16 MECHANICAL CHARACTERISTICS 2-24

2.17 ENVIRONMETAL CHARACTERISTICS 2-24
2.17.1 General 2-24
2.17.2 Environmetal 2-24
2.17.3 EMI 2-25

2.18 SAFETY 2-26

2.19 ACCESSORIES 2-26

2.20 OPTIONS & OPTIONAL VERSIONS 2-26
2.20.1 Options Line cord 2-26
2.20.2 Options digital versions 2-27
2.20.3 Options analog versions 2-27
2.20.4 Specification optional outputs 2-27
2.20.5 Specification IEEE-OPTION 2-28
2.20.6 Extended memory 2-29

3. DESCRIPTIONS 3-1

3.1 GENERAL DESCRIPTION 3-1
3.1.1 Introduction to oscilloscope family 3-1
3.1.2 Introduction to descriptions 3-1
3.1.3 Explanation of signal names 3-2
3.1.4 Voltage values in the circuit diagrams 3-2

3.2 BLOCK DIAGRAM DESCRIPTION 3-7
3.2.1 Introduction 3-7
3.2.2 Vertical channels 3-8
3.2.3 Triggering and time bases 3-9
3.2.4 Final amplifiers 3-10
3.2.5 Front unit and microprocessor 3-11
3.2.6 Power supply 3-11
3.2.7 Digitizer 3-12

4. PARTS 4-1

4.1 UNITS 4-1

4.2 INTERCONNECTIONS 4-2

4.3 MECHANICAL PARTS 4-4

5. UNIT DESCRIPTIONS 5.1-1

5.1 SIGNAL UNIT A1 . . . . . 5.1-1
5.1.1 Description 5.1-1
5.1.2 Signal name list 5.1-14
5.1.3 Unit lay-outs 5.1-21
5.1.4 Location list 5.1-23
5.1.5 Circuit diagrams 5.1-33
5.1.6 Differences between typening 5.1-55
5.1.7 Parts lists 5.1-57

5.2 FINAL XYZ AMPLIFIER A2 . . . . . 5.2-1
5.2.1 Description of A2-200 MHz version 5.2-1
5.2.2 Signal name list A2-200 MHz version 5.2-5
5.2.3 Unit lay-outs A2-200 MHz version 5.2-7
5.2.4 Location list A2-200 MHz version 5.2-9
5.2.5 Circuit diagram A2-200 MHz version 5.2-13
5.2.6 Parts A2-200 MHz version 5.2-19
5.2.7 Description of A2-100 MHz version 5.2-35
5.2.8 Signal name list A2-100 MHz version 5.2-39

5.2.9 Unit lay-outs A2-100 MHz version ... 5.2-41
5.2.10 Location list A2-100 MHz version ... 5.2-43
5.2.11 Circuit diagram A2-100 MHz version ... 5.2-47
5.2.12 Parts A2-100 MHz version ... 5.2-53

5.3 MICROPROCESSOR A3 ... 5.3-1
5.3.1 Description ... 5.3-1
5.3.2 Signal name list ... 5.3-2
5.3.3 Unit lay-outs ... 5.3-5
5.3.4 Circuit diagrams ... 5.3-7
5.3.5 Parts lists ... 5.3-11

5.4 FRONT UNIT A4 AND CRT CONTROLS UNIT A5 ... 5.3-1
5.4.1 Description ... 5.3-1
5.4.2 Signal name list ... 5.3-1
5.4.3 Key switches ... 5.3-2
5.4.4 Unit lay-outs ... 5.3-5
5.4.5 Circuit diagrams ... 5.3-7
5.4.6 Parts lists ... 5.3-9

5.5 CRT CONTROLS UNIT A5 ... 5.5-1
5.5.1 Description ... 5.5-1
5.5.2 Unit lay-outs ... 5.5-2
5.5.3 Circuit diagram ... 5.5-3
5.5.4 Parts ... 5.5-4

5.6 POWER SUPPLY A6 ... 5.6-1
5.6.1 Description ... 5.6-1
5.6.2 Signal name list ... 5.6-5
5.6.3 Unit lay-outs ... 5.6-7
5.6.4 Circuit diagrams ... 5.6-9
5.6.5 Parts lists ... 5.6-13

5.7 RESERVED FOR FUTURE EXTENSIONS ... 5.7-1

5.8 DIGITIZER A8 ... 5.8-1
5.8.1 Description ... 5.8-1
5.8.2 Signal name list ... 5.8-23
5.8.3 Unit lay-outs ... 5.8-29
5.8.4 Location list ... 5.8-33
5.8.5 Circuit diagram ... 5.8-39
5.8.6 Parts ... 5.8-57

5.9 RESERVED FOR FUTURE EXTENSIONS ... 5.9 - 1

5.10 CONNECTOR BOARD A10 ... 5.10-1
5.10.1 Unit lay-out ... 5.10-1
5.10.2 Circuit diagrams ... 5.10-3
5.10.3 Parts lists ... 5.10-5

5.11 FACTORY INSTALLED OPTIONS ... 5.11-1
5.11.1 IEEE-option ... 5.11-1
5.11.2 Auxiliary outputs option ... 5.11-1
5.11.3 External Trigger option ... 5.11-7

6. PERFORMANCE TEST 6-1

6.1 GENERAL INFORMATION 6-1

6.2 RECOMMENDED TEST EQUIPMENT 6-2

6.3 TEST PROCEDURE 6-3
6.3.1 Preliminary settings 6-3
6.3.2 Power Supply 6-3
6.3.3 Auto set 6-4
6.3.4 Orthogonality 6-4
6.3.5 Trace disortion 6-6
6.3.6 Vertical deflection; deflection coefficients 6-6
6.3.7 Vertical deflection; variable gain control range 6-8
6.3.8 Vertical deflection; input coupling 6-8
6.3.9 Vertical cursor accuracy 6-8
6.3.10 Vertical deflection; high-frequency response 6-9
6.3.11 Vertical deflection; low-frequency response 6-10
6.3.12 Vertical deflection; dynamic range at 25/50 MHz 6-10
6.3.13 Vertical deflection; dynamic range at 100/200 MHz 6-11
6.3.14 Vertical deflection; position range 6-12
6.3.15 Vertical deflection; cross talk at 100/200 MHz 6-12
6.3.16 Vertical deflection; common mode rejection ratio at 1 MHz 6-13
6.3.17 Vertical deflection; common mode rejection ratio at 100 MHz 6-14
6.3.18 Vertical deflection; LF linearity 6-14
6.3.19 Vertical deflection; visual signal delay 6-15
6.3.20 Vertical deflection; base line instability 6-16
6.3.21 Delay difference between vertical channels 6-17
6.3.22 Horizontal deflection; display modes and trace separation 6-19
6.3.23 Horizontal deflection; X deflection 6-20
6.3.24 Horizontal deflection; main time-base deflection coefficients 6-21
6.3.25 Horizontal deflection; VARiable mode accuracy MAIN TB 6-23
6.3.26 Time cursor accuracy 6-23
6.3.27 Horizontal deflection; delayed time-base deflection coefficients 6-24
6.3.28 Horizontal deflection; delay time multiplier 6-25
6.3.29 Horizontal deflection; delayed time-base jitter 6-26
6.3.30 Horizontal deflection; X deflection coefficient via CH1 6-26
6.3.31 Horizontal deflection; X deflection coefficient via line 6-27
6.3.32 Horizontal deflection; high frequency response 6-28
6.3.33 Maximum phase shift between horizontal and vertical deflection 6-28
6.3.34 MAIN TB triggering; trigger sensitivity PM3392/3394 6-30
6.3.35 MAIN TB triggering; trigger sensitivity PM3382/3384 6-31
6.3.36 MAIN TB/Delayed TB triggering; trigger sensitivity TVL-TVF 6-32
6.3.37 Delayed TB triggering; trigger sensitivity PM3392/3394 6-32
6.3.38 Delayed TB triggering; trigger sensitivity PM3382/3384 6-34
6.3.39 Trigger sensetivity in logic mode PM3392/3394 6-35
6.3.40 Trigger sensetivity in logic mode PM3382/3384 6-36
6.3.41 Z-MOD sensitivity 6-37
6.3.42 CAL signal; frequency and output voltage 6-38

7. CALIBRATION ADJUSTMENT PROCEDURE 7-1

7.1 INTRODUCTION 7-1
7.2 DARK LEVEL OF CRT 7-1
7.3 TRACE ROTAION 7-2
7.4 HORIZONTAL GAIN AND OFFSET 7-2
7.5 TEXT STABILITY AND X-OFFSET (CRT) 7-2
7.6 VERTICAL GAIN AND OFFSET (CRT) 7-2
7.7 TEXT STABILITY AND X-OFFSET (VECTOR) 7-3
7.8 VERTICAL GAIN AND OFFSET (VECTOR) 7-3
7.9 ASTIGMATISM 7-3
7.10 AUTOCAL PROCEDURE 7-3
7.11 LF SQUARE-WAVE RESPONSE CH1 7-4
7.12 LF SQUARE-WAVE RESPONSE CH2 7-5
7.13 LF SQUARE-WAVE RESPONSE CH3 7-5
7.14 LF SQUARE-WAVE RESPONSE CH4 7-5
7.15 HF SQUARE-WAVE RESPONSE FINAL Y AMPLIFIER 7-6
7.16 HF RESPONSE DSO MODE 7-7
7.17 TRIGGER DELAY ADJUSTMENT 7-8
7.18 SAVING THE CALIBRATION DATA 7-9
7.19 TESTING THE INSTRUMENTS PERFORMANCE 7-9

8. CORRECTIVE MAINTENANCE PROCEDURES 8-1

8.1 DISMANTLING THE INSTRUMENT 8-1
8.1.1 General information 8-1
8.1.2 Removing the cabinet and carrying handle 8-1

8.2 REPLACEMENTS 8-1
8.2.1 Standard parts 8-2
8.2.2 Special parts 8-2
8.2.3 Transistors and integrated circuits 8-2

8.3 STATIC SENSITIVE COMPONENTS 8-2

8.4 SOLDERING TECHNIQUES 8-3
8.4.1 General soldering techniques 8-3
8.4.2 Soldering micro-miniature semi-conductors 8-3

8.5 REMOVING THE UNITS, MECHANICAL PARTS AND CRT 8-4
8.5.1 Removing the rotary knobs 8-4
8.5.2 Detachment of ribbon cables 8-4
8.5.3 Removal of signal unit A1 8-5
8.5.4 Removal of final XYZ amplifier unit A2 8-6
8.5.5 Removal of unit at socket of CRT 8-7
8.5.6 Removal of Cathode Ray Tube (CRT) 8-7
8.5.7 Removal of microprocessor A3 8-7
8.5.8 Removal of the units in the front frame 8-8
8.5.9 Removal of the power supply unit A6 8-8
8.5.10 Removal of digitizer unit A8 8-9

8.6 INSTRUMENT REPACKING 8-9

8.7 TROUBLESHOOTING TECHNIQUES 8-9

8.8 TROUBLESHOOTING THE POWER SUPPLY 8-10

8.9 SPECIAL TOOLS 8-11
8.9.1 Extension board 8-11
8.9.2 Flash-ROM loader program 8-11

8.10 RECALIBRATION AFTER REPAIR 8-11

8.11 TESTS BUILT INTO THE INSTRUMENT 8-12
8.11.1 Power-up test 8-12
8.11.2 Introduction to diagnostic tests 8-12
8.11.3 Selftest 8-15
8.11.4 Repair tools 8-17

9 SAFETY INSPECTION AND TESTS AFTER REPAIR AND MAINTENANCE IN THE PRIMARY CIRCUIT 9-1

9.1 GENERAL DIRECTIONS 9-1

9.2 SAFETY COMPONENTS 9-1

9.3 CHECKING PROTECTIVE GROUND 9-1

9.4 CHECKING INSULATION RESISTANCE 9-1

9.5 CHECKING LEAKAGE CURRENT 9-1

9.6 VOLTAGE TEST 9-1

1 SAFETY INSTRUCTIONS

Read these pages carefully before installation and use of the instrument.

1.1 INTRODUCTION

The following paragraphs contain information, cautions and warnings which must be followed to ensure safe operation and to keep the instrument in a safe condition.

WARNING: Servicing described in this manual is to be done only by qualified service personnel. To avoid electric shock, do not service the instrument unless you are qualified to do so.

1.2 SAFETY PRECAUTIONS

For the correct and safe use of this instrument it is essential that both operating and servicing personnel follow generally accepted safety procedures in addition to the safety precautions specified in this manual.
Specific warning and caution statements, where they apply, will be found throughout the manual.
Where necessary, the warning and caution statements and/or symbols are marked on the apparatus.

1.3 CAUTION AND WARNING STATEMENTS

CAUTION: Is used to indicate correct operating or maintentance procedures in order to prevent damage to or destruction of the equipment or other property.

WARNING: Calls attention to a potential danger that requires correct procedures or practices in order to prevent personal injury.

1.4 SYMBOLS

Live part (black/yellow)

High voltage terminal ≥ 1000 V (red)

Attention refer to the manual:
This symbol is to indicate that information about usage of a feature is contained in the manual.

Protective ground terminal (black)

Static sensitive components (black/yellow)

1.5 IMPAIRED SAFETY-PROTECTION

Whenever it is likely that safety has been impaired, the instrument must be turned off and disconnected from line power. The matter should then be referred to qualified technicians. Safety protection is likely to be impaired if, for example, the instrument fails to perform the intended measurements or shows visible damage.

1.6 GENERAL SAFETY INFORMATION

WARNING: Removing the instrument cover or removing parts, except those to which access can be gained by hand, is likely to expose live parts and accessible terminals which can be dangerous to live.

The instrument shall be disconnected from all voltage sources before it is opened.

Capacitors inside the instrument can hold their charge even if the instrument has been separated from all voltage sources.

WARNING: Any interruption of the protective ground conductor inside or outside the instrument, or disconnection of the protective ground terminal, is likely to make the instrument dangerous. Intentional interruption is prohibited.

Components which are important for the safety of the instrument may only be replaced by components obtained through your local FLUKE/PHILIPS organisation. (See also section 9).

After repair and maintenance in the primary circuit, safety inspection and tests, as mentioned in section 9 have to be performed.

2 CHARACTERISTICS

A. Performance Characteristics

- Properties expressed in numerical values with tolerances, ranges, or limits stated, are guaranteed by the manufacturer.
  Properties expressed in numerical values without tolerances, ranges, or limits stated, represent the characteristics of an average instrument.
  This specification is valid if the temperature has not changed more than + or - 5 °C since the last AUTO CAL, the probe is of the same type as delivered with the instrument, and if the average factor is 8.
  For definitions of terms, reference is made to IEC Publication 351-1, 359.

B. Safety Characteristics

This instrument has been designed and tested in accordance with IEC Publication 348, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. This manual contains information and warnings which must be followed by the user to ensure safe operation and to keep the instrument in safe condition. The instrument has been designed for indoor use. It may occasionally be subjected to temperatures between +5 °C and 10 °C without degradation of its safety.

C. General Characteristics

- Overall dimensions:
  - Height (without feet) : 139 mm (5.5 in)
  - Width (without handle) : 341 mm (13.5 in)
  - Length (without handle and front cover) : 481 mm (19 in)

Figure 2.1 Dimensions

- Weight 9.5 kg (19.7 lb)
- Operating positions:
  a) Horizontally on bottom feet
  b) Vertically on rear feet
  c) On the carrying handle in three sloping positions

Note: All items that refer specifically to only one mode (analog or digital) are identified in the leftmost column with an 'A' or a 'D'.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.1 VERTICAL

2.1.1 Channels

CHANNELS	CH1; CH2;	Form a channel set
	CH3; CH4	Form a channel set

2.1.2 Deflection Modes (Analog Only)

MODES	CH1, CH2, CH3, CH4	CH2 and CH4 can be inverted to allow -CH2 or -CH4
	CH1 + CH2	CH2 can be inverted to allow CH1 - CH2
	CH3 + CH4	CH4 can be inverted to allow CH3 - CH4
	Alternate	
	Chopped	
Chopped mode:		
Chopped freq.	1 MHz	

2.1.3 Bandwidth

FREQUENCY RESPONSE		At BNC
Lower transition point of BW input coupling in AC pos	<10 Hz	BW = bandwidth
PM3392 and PM3394		
Upper transition point of BW		BW = bandwidth
(Ambient 5 to 40 °C)	>200 MHz	See Note 1
(Ambient 0 to 50 °C)	>175 MHz	See Note 1
PM3382 and PM3384		
Upper transition point of BW	BW = bandwidth	
(Ambient 5 to 40 °C)	>100 MHz	With external 50Ω
(Ambient 0 to 50 °C)	>90 MHz	With external 50Ω
BANDWIDTH LIMITER		
Upper transition point of BW	20 MHz	BW = bandwidth

Note 1: PM3394 CH1 through CH4 in 50Ω position at BNC. PM3392 CH1 and CH2 in 50Ω position at BNC and CH3 and CH4 at probe tip.

2.1.4 Attenuator

CH1 and CH2 (PM3382/PM3392) steps	2 mV/div to 5V/div	In a 1-2-5 sequence
CH3 and CH4 (PM3382/PM3392) steps	0.1V/div, 0.5V/div	
CH1 to CH4 (PM3384/PM3394) steps	2 mV/div to 5V/div	In a 1-2-5 sequence
Variable gain mode	2 mV/div to 12.5V/div	Continuously variable

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.1.5 Input Characteristics

INPUT CONNECTOR	BNC	See Note 1
INPUT IMPEDANCE (in 1 MΩ pos.)		Measured at freq. <1MHz
R parallel-value	1 MΩ	
- tolerance	±1 %	
C parallel-value	25 pF	
- tolerance	±2 pF	
INPUT INPEDANCE (in 50Ω pos.)		PM3392 only CH1 and CH2 PM3394 all channels
R parallel value	50Ω	
- tolerance	±1 %	
VSWR (typical)	1.5:1	See Note 2

Note 1: BNC with Probe Readout pin which causes the instrument to change V/div indication, input impedance, and attenuator setting according to the probe (when equiped with a probe indicator).

Note 2: Measured up to 200 MHz input frequency; in dc and ac coupling of input.

2.1.6 Coupling

COUPLING	dc, ac, ground	See Note 1

Note 1: In GND position: channel disconnected from input, and connected to ground, BNC open (when not in 50Ω position). The GND coupling is not available for channel CH3 and CH4 in PM3382 and PM 3392.

2.1.7 Dynamic Range

DYNAMIC RANGE Up to 25 MHz PM3382/PM3384	±12 div	Symmetrical
Up to 50 MHz PM3392/PM3394	±12 div	Symmetrical
Up to 100 MHz PM3382/PM3384	±4 div	Symmetrical
Up to 200 MHz PM3392/PM3394	±4 div	Symmetrical

2.1.8 Position Range

POSITION RANGE	±8 div	Symmetrical

2.1.9 Trace Separation

TRACE SEPARATION		MTB and DTB
Min. range	+ or - ≥ 4 div	MTB fixed, DTB shifts

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.1.10 Input Voltage Limits

INPUT VOLTAGE LIMITS		See Note 1
In high Z position	± 400V	See Note 2
(dc + ac peak) dc		
In 50Ω position	± 5V	
ac rms	5V	See Note 3
ac peak	± 50V	See Note 3

Note 1: The instrument should be properly grounded through the protective ground conductor of the power cord.

Note 2: Up to 10 KHz; >10 kHz see figure 2.2

Note 3: Maximum of 50 mJ during any 100 ms interval.

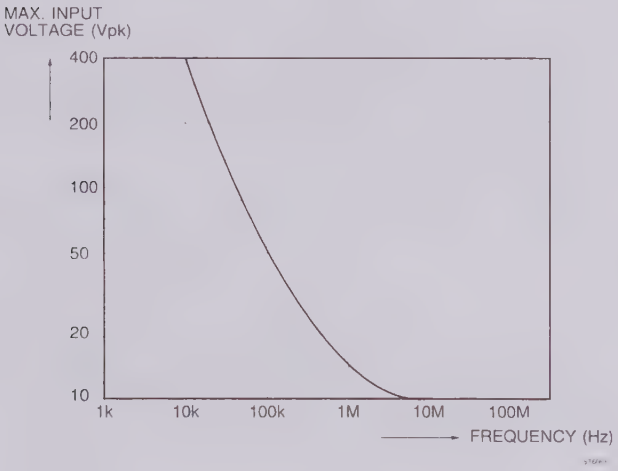


Figure 2.2 Max. input voltage versus frequency

2.1.11 Step Response

5 Divisions Pulse In 50Ω Input Impedance

STEP RESPONSE	See Note 1

Note 1: Calculated from the formula: Rise time = 0.35 / Bandwidth and is measured over the central 5 divisions (vertical)

2.1.12 Signal Delay

A: VISUAL SIGNAL DELAY	15 ns	
DELAY BETWEEN CHANNELS		
CH1 and CH2	<250 ps	
CH3 and CH4	<250 ps	
CH1.... CH4	<250 ps	4 channel instruments
Any two channels	<500 ps	2+2 channel instruments

2.1.13 Vertical Accuracies

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
ACCURACY		
deflection factor		
A: Gain error (dc)	±1.3 %	Over central 6 divisions See Note 1
D: Additional gain error(dc)	±0.7 %	See Note 2
A: Non-linearity	≤2 %	See Note 2
D: Digital non-linearity	≤4.5 %	See Note 2
MAX. BASELINE INSTABILITY		
Jump (all between steps, var, and N/I)	0.2 div or 1 mV	Whichever is greater (after autocal)
Drift	0.1 div/h	
Temperature coefficient	0.03 div/K	
CHANNEL ISOLATION		
Of deselected channels at 10 MHz	100:1	See Note 3
Of deselected channels at upper transition point	50:1	See Note 4
Between selected channels	50:1	See Note 5

Note 1: Add 1.5% for variable gain mode.

Note 2: 2 division center screen signal with a frequency of 50 kHz, shifted within graticule area.

Note 3: At 10 MHz; input to deselected channel equivalent to 8 divisions or less.

Note 4: PM3392/3394 at 200 MHz; PM3382/3384 at 100MHz; channels equal V/div setting; input to deselected channels equivalent to 6 divisions.

Note 5: PM3392/3394 at 200 MHz; PM3382/3384 at 100MHz; channels with equal V/division settings; input to either channel 6 div. PM3392/3394 max. input amplitude 3Vpp.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.2 TIMEBASE

2.2.1 Timebase (modes)

TIMEBASE MODES	MTB only MTB and DTB DTB only	MTB= Main Timebase Alternating TB-mode DTB = Delayed Timebase
MTB trigger modes	AUTO TRIGGERED SINGLE SHOT SINGLE SCAN	Free run after 100 ms
DTB trigger modes	DTB starts DTB triggered	Starts after delay time Starts on first trigger after delay time

2.2.2 Timebase Settings (Analog Mode Only)

MTB PM3392/PM3394 Settings	0.5s/div to 20 ns/div	See Note 1
PM3382/PM3384 Settings	0.5s/div to 50 ns/div	See Note 1
PM3392/PM3394 Variable Time/Div range	1.25s/div to 20 ns/div	MTB continuously variable
PM3382/PM3384 Variable Time/Div range	1.25s/div to 50 ns/div	MTB continously variable
DTB PM3392/PM3394 Settings	0.5 ms/div to 20 ns/div	See Note 1 See Note 3
PM3382/PM3384 Settings	0.5 ms/div to 50 ns/div	See Note 1 See Note 3
TIMEBASE MAGNIFICATION	10x	See Note 2

Note 1: In a 1-2-5 sequence. By means of the timebase magnifier (x10) the range is extended to 2 ns/div (PM3392/94) or 5ns/div (PM3382/84).

Note 2: Expands the normal time/div by 10 times (MTB and DTB)

Note 3: The DTB sweep speed is higher or equal to MTB time/div setting.

2.2.3 DTB Delay (Analog Mode Only)

DELAY TIME	2 ns to 4.9s
Position range	0.1 div to 9.9 div
Resolution	1: 40000

2.2.4 Timebase Settings (Digital Mode Only)

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
MTB Settings		
REAL TIME SAMPLING	200s/div to 250 ns/div	See Note 1 and 4
ROLL	200s/div to 200 ms/div	See Note 2
RANDOM SAMPLING		
PM3392/94	200 ns/div to 2 ns/div	See Note 2
PM3382/84	200 ns/div to 5 ns/div	See Note 2
DTB Settings		See Note 5
STARTS		
REAL TIME SAMPLING	0.5 ms/div to 250 ns/div	Whichever is greater
	0.5 ms/div to 0.001x MTB setting	See Note 1 and 3
RANDOM SAMPLING only for MTB	200 µs/div to 2 ns/div	
PM3392/94	200 ns/div to 2 ns/div	Whichever is greater
	200 ns/div to 0.001x MTB setting	See Note 2 and 3
PM3382/84	200 ns/div to 5 ns/div	Whichever is greater
	200 ns/div to 0.001x MTB setting	See Note 2 and 3
TRIGGERED		
REAL TIME SAMPLING	0.5 ms/div to 250 ns/div	See Note 1 and 3
RANDOM SAMPLING		
PM3392/94	200 ns/div to 20 ns/div	See Note 2 and 3

Note 1: In a 1-2-5 sequence 250 ns.

Note 2: In a 1-2-5 sequence.

Note 3: The DTB sweep speed is higher or equal to MTB time/div. setting.

Note 4: In DTB: 500 ms/div to 250 ns/div.

Note 5: DTB is only possible with normal acquisition length.

Note 6: Triggered DTB is not possible in combination with tv, logic or event delay trigger mode.

2.2.5 Timebase Delay (Digital Mode Only)

TIME DELAY		
TRIGGER POSITION		
Acquisition length normal	-10 to 0 div	pretrigger
Acquisition length max.	-160 to 0 div	pretrigger
DELAY	0 to 1000 div	posttrigger
Resolution	steps of 0.02 div	sample distance
EVENTS DELAY		
Range	1 to 16384	See event counter

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.2.6 DTB Delay (Digital Mode Only)

TRIGGERED		
DELAY TIME	2 ns to 4.9 s	
Position range	0.1 div to 9.9 div	
Resolution	1 : 40000	
STARTS		
DELAY TIME	0 to 10 div of MTB setting	
Position range	0 div to 10 div	
Resolution	1 : 40000	

2.2.7 Analog Timebase Accuracies

Unmagnified:	± (1.3% of reading +0.5% of central 8 div)	See Note 1
Magnified:		See Note 2
Up to 10 ns div	± (1.3% of reading +1.0% of central 8 div)	See Note 1
In 5ns/div and 2ns/div	± (1.8% of reading +1.5% of central 8 div)	See Note 1

Note 1: Add 1% of reading in variable mode.

Note 2: Valid over central unmagnified 8 divisions.

2.2.8 Delaytime Accuracy (Analog Mode)

MTB in 20 µs/div DTB in 2 µs/div	± (0.8% of reading +0.3% of central 8 div + 4 ns)	See Note 1

Note 1: add 1% of reading in variable mode.

2.2.9 DTB Jitter In Starts (Analog Mode)

Jitter	1 part of 25000

2.2.10 Timebase Accuraries (Digital Mode)

MTB, DTB	
Real time modes	± (0.8% of reading
DTB in 2 µs/div	+ 0.5% of central 8 div)
up to memory	± 0.010%
Equivalent mode	± (1.3% of reading + 0.5% of central 8 div)
up to memory	± 0.5%

2.2.11 DTB Jitter In Starts (Digital Mode)

Jitter	120 ps

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.2.12 External Horizontal Deflection

This paragraph is valid only for the analog mode. In the digital mode X versus Y is defined as a display mode.

DEFLECTION SOURCES	Line and CH1 to CH4	
LINE DEFLECTION Deflection amplitude	6 ±1.7 div	Between 49 and 61 Hz at 220 volts
CHANNEL DEFLECTION		Refer to VERTICAL
Error limit	±5%	Over central 6 divisions
Linearity error limit	±2%	See Note 1
Dynamic range up to 100 kHz up to 2 MHz	 20 div 10 div	
POSITION RANGE	±5 div	
FREQUENCY RESPONSE Upper transition point	 2 MHz	
MAX. PHASE DIFFERENCE Between horizontal and vertical	3°	Up to 100 kHz

Note 1: 2 div/50kHz center screen signal shifted within central 8 divisions.

2.3 TRIGGERING

2.3.1 Source

SOURCE (S) MTB triggering	CH1 to CH4 Line	
SOURCE(S) DTB triggering	 CH1 to CH4	

2.3.2 Modes

MODES MTB triggering	EDGE TV D:PATTERN	 Enter/exit pattern plus timed pattern
	D:STATE D:GLITCH	
MODES DTB triggering	EDGE	

2.3.3 TV Systems

TV systems	TV	See Note 1
	HDTV	See Note 1

Note 1: Line selection possible in field1and field2.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
2.3.4 Coupling		
BANDWIDTH EDGE TRIGGER MTB		Vertical coupling in DC
Lower transition point of BW		BW = Bandwidth
Trigger coupling:		
DC	dc	
AC	10 Hz	
LF-reject	30 kHz	
HF-reject	dc	
Upper transition point of BW		BW = Bandwidth
Trigger coupling:		
DC	)	
AC	)See sensitivity	
LF-reject	)	
HF-reject	30 kHz	
BANDWIDTH EDGE TRIGGER DTB		Vertical coupling in DC
Lower transition point of BW		BW = bandwidth
Trigger coupling:		
DC	dc	
AC	10 Hz	
LF-reject	30 kHz	
HF-reject	dc	
Upper transition point of BW		BW = bandwidth
Trigger coupling:		
DC	)	
AC	)See sensitivity	
LF-reject	)	
HF-reject	30 kHz	
2.3.5 Sensitivity		
EDGE TRIGGER SENSITIVITY MTB and DTB of PM3392/PM3394		See Notes 1,3 and 4
dc to 100 MHz	0.6 div	
dc to 200 MHz	1.2 div	
dc to 300 MHz	2.0 div	See Note 2
EDGE TRIGGER SENSITIVITY MTB and DTB of PM3382/PM3384		See Notes 1,3 and 4
dc to 50 MHz	0.6 div	
dc to 100 MHz	1.2 div	
dc to 200 MHz	2.0 div	See Note 2

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
TV TRIGGER SENSITIVITY (ampl. of sync. pulse)	0.7 div	See Note 1
TRIGGER SENSITIVITY D: PATTERN/STATE PM3392/PM3394 rectangular pulses		See Note 1,4
t ≥ 10 ns t ≥ 2 ns	1.0 div 2.0 div	See Note 5
PM3382/PM3384 rectangular pulses		
t ≥ 20 ns t ≥ 4 ns	1.0 div 2.0 div	See Note 5

Note 1: All figures are valid for an ambient temperature range of 5 to 40 °C, add 20% for ambient 0 to 50 °C.

Note 2: Measured with a 2 divisions center screen signal.

Note 3: In noise trigger multiply stated value by 2

Note 4: In 2...5 mV/div multiply stated value by 2.

Note 5: Duty cycle 50%.

2.3.6 Slope

Slope selection edge	+ or -	MTB and DTB See Note 1
D: Dual slope	Up to full vertical bandwith	See note 2

Note 1: In TV-triggering positive/negative video.

Note 2: Only in single shot, real time mode.

2.3.7 Level

LEVEL CONTROL RANGE MTB EDGE Unless: In level p(eak)p(eak) TV	±8 div Fixed	 See Note 1
D: PATTERN, STATE and GLITCH	±5 div	
LEVEL CONTROL RANGE DTB EDGE	±8 div	

Note 1: The control range of the trigger level is related to the peak-peak value and duty cycle of the trigger signal.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.3.8 Logic Triggering Timing (Digital Mode Only)

PATTERN/GLITCH DETECTION		
Max. pattern rate	150 MHz	
Min. present time		
PM3394/92	2 ns	Pulse amplitude >2 div
PM3384/82	4 ns	Pulse amplitude >2 div
range t_1	20 ns, 30 ns, 40 ns, 50 ns to 0.16s	See note 1
range t_2	20 ns, 40 ns, 50 ns, 60 ns to 0.16s	See note 1
accuracy t_1 t_2	±5 ns	
STATE DETECTION		
Max. state rate	150 MHz	
Min. setup time	2.5 ns	Pattern to clock
Min. hold time	2.5 ns	Pattern to clock

Note 1: Timing behavior around t_1 and t_2.

Pattern valid time:

```
------|********|TTTTTTTTTTTTTTTTTTTT|********|-------
```

t_1 t_1+10 ns t_2-10 ns t_2

- : not triggered
* : undefined
T: triggered

2.3.9 Trigger Accuracies

TRIGGER LEVEL		
Accuracy edge	≤0.2 div	At 1 MHz input signal
D: Accuracy logic	≤0.4 div	At 1 MHz input signal
Trigger gap edge	0.4 div	At 1 MHz input signal in noise trigger multiply by 2
FALSE TRIGGERS	1:100000	See Note 1

Note 1: These values are not tested in production and are based on theoretical estimates and laboratory tests.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.4 EVENT COUNTER

Event delay		
EDGE	1 to 16384	See Note 1
TV line	1 to n	See Notes 1 and 2
Event enable source	CH1 to CH4 Line Logic	
Event clock	CH1 to CH4	
Event clock mode	Edge	
Event clock slope selection	+ or -	
Event clock coupling	AC, DC	
Event clock sensitivity		
DC to 50 MHz	0.5 div	
Event clock level	8 div	
Max. count frequency	50 MHz	typical value

Note 1: In DSO mode, triggered DTB in combination with Event is not possible

Note 2: n is equal to maximum lines of TV system

2.5 HOLD-OFF

HOLD OFF SETTING		
A: Minimum	2 µs or 3 divisions of MTB setting	Whichever is greater
A: Maximum	2s or 20 divisions of MTB setting	Whichever is smaller
D: Minimum	4 ms	See Note 1
D: Maximum	20 divisions of MTB setting	

Note 1: For total hold off time, the process time must be included. See also ACQUISITION TIME.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.6 PROCESSING

2.6.1 Preprocessing

PREPROCESSING FUNCTIONS		See Note 1
	Invert	CH2; CH4
	Add	CH1+CH2; CH3+CH4; See Note 2
	Subtract	CH1-CH2; CH3-CH4; See Note 2
D:	Peak detection	
D:	Average	See Note 3
D:	Envelope	

Note 1: These functions are performed before the acquisition data is stored in the acquisition registers.

Note 2: Dynamic range in digital mode ±5 div.

Note 3: Average factor 2 to 4096 in power of 2 sequence.

2.6.2 Register Processing (Digital Mode)

REGISTER PROCESSING FUNCTION		See Note 1
	Add	See Note 2
	Sub	See Note 2
	Mul	See Note 2
	Filter	LF filter with adjustable -3dB point

Note 1: There may be run two processes simultaneously. The acquisition registers can also be used as source registers. The result from process one will be stored in memory one. The result from process two will be stored in memory two.

Note 2: The source can be any trace from any register except the result register. The result can be scaled.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.7 TRACE MEASUREMENTS (DIGITAL MODE)

TRACE MEASUREMENTS FUNCTIONS		See Note 1
Horizontal	Frequency Period Pulse width Rise / fall	
Vertical (with or without offset)	Mean RMS Maximum Minimum Peak/peak Low High Overshoot Preshoot Duty cycle Delay	

Note 1: These measurements can be performed on traces stored in the acquisition and memory registers.

2.8 CURSORS

2.8.1 Cursor Control

NUMBER OF CURSORS	4	
CURSOR RELATION D:	Screen Trace	Free Follows the trace
CURSOR MODES	Time Amplitude Both	 Only screen cursor
Amplitude cursor modes	Absolute Ratio	 See Note 1
Time cursor modes	Absolute Ratio	 See Note 1

Note 1: The ratio range is 0% to 999% where 100% corresponds to the value in the cursor read out at the moment that the "ΔT=100%" button is pressed.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.8.2 Cursor Readouts

CURSOR READOUTS	dV	
	dT	See Note 1
	V to GND	
	1/dT	See Note 1
READOUT RESOLUTION	3 digits	

Note 1: In the "MTB + DTB timebase" and "DTB", all waveform operations and measurements are performed on the DTB traces.

2.8.3 Cursor Accuracies (Analog Mode)

Voltage measurements		Note 1
Manual	±1% of FULL SCALE	
Time measurements		Note 2
Unmagnified timebase	±1% of FULL SCALE	
Magnified timebase up to 10 ns/div	±1.4% of FULL SCALE	
Magnified timebase in 5 ns/div and 2 ns/div	±2.2% of FULL SCALE	

Note 1: Measured with 1 kHz square wave within central 6 div.

Note 2: within central 8 div.

2.8.4 Cursor Accuracies (Digital Mode)

ERROR LIMIT VERTICAL	See vertical accuracy
ERROR LIMIT HORIZONTAL	See horizontal accuracy

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.9 DIGITAL ACQUISITION

2.9.1 Modes

MODES Select one:	Recurrent Single shot/scan Roll	 Stop on trigger continuous

2.9.2 Sample Rate

Real time	Max. Sample rate 200Ms/s	500 ns/div to 200s/div See Note 1
Equivalent time	Random sampling	2 ns/div to 0.2 µs/div

Note 1: Sampling rate depends on time/division setting.

2.9.3 Multiplexed Channels

This instrument has 4 channels, which are configured as 2 + 2. This implies, that the channels CH1 and CH2 are multiplexed with the channels CH3 and CH4 to share the same dual channel digitizer.

Multiplexed channels (CH1 and CH2) or (CH3 and CH4)	simultaneously	See Note 1
Any other combination for timebase settings 200s/div to 10 µs/div 5 µs/div to 2 ns/div	CHOPPED ALTERNATED	See Note 2
Max. Chop freq.	5 MHz	

Note 1: At 250 ns/div each of the four channels is acquired in alternated mode.

Note 2: When peak detection is activated the multiplexing is in alternated mode.

2.9.4 Trace Memory

This digitizer has a total acquisition memory size of 8K bytes. To apply this memory as efficiently as possible, it is shared by all channels connected to it. The following section summarizes the effects:

Record length normal 1 to 4 channels selected	512 samples/channel	
Record length 'Max' 1 to 4 channels 1 of 4 channels	2K samples/channel 8K samples	See Note 1
Display	501 samples/trace	

Note 1: When peak detection or envelope is activated, all "max" record length figures have to be divided by 2 because samples are stored as peak/peak combinations.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.9.5 Acquisition Time

The process time between acquisitions depends from the selected settings and the selected processing. Therefore it is not possible to catch the process time between acquisitions in a formula. The next table gives an indication of the performance of the processing capabilities.

Process time between acquisitions 500 ns/div one channel no trigger delay acquisition length = 512	6 ms	See Note 1 Holdoff is min and no processes or measurements are active
500 ns/div two channel no trigger delay acquisition length = 512 average = 8	16 ms	Holdoff is min and no other processes or measurements are active
Equivalent time		See Note 2
Timebase:		
- at 2 ns/div	2s	
- at 0.2 µs/div	100 ms	

Note 1: Time required to fill the acquisition record at the sampling rate corresponding with the selected timebase setting is not included.

Note 2: After the specified time, there is a 99% probability of all sample positions being updated to the new acquisition. Trigger frequency >2 kHz. These values are not tested in production and are based on theoretical estimates and laboratory tests.

2.9.6 Resolution

ACQUISITION RESOLUTION	8 bits	over 10.24 divisions

2.9.7 Registers

NUMBER OF REGISTERS		Including current acquisition
Acquisition length:		One set contains:
- Normal	9 sets	Four traces
- Max: -4x2k	3 sets	Four traces
-2x4k		Two traces
-1x8k		One trace
WORD LENGTH	16 bits	

2.9.8 Register Manipulations

Clear	The contents of the selected register is set to zero
Save	The contents of the acquisition register is stored in the selected register
Copy	The contents of a selected register is stored in another selected register
Recall	The register can be made visible on the display or can be removed from the display

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.9.9 Digital Acquisition Accuracies

SAMPLING RATE ERROR	±0.01%	X-tal
TIME UNCERTAINTY At double sampling rate	±100ps	

2.10 FRONT PANEL MEMORY

Memory size	10 fronts	

2.11 BLANKING OR Z-AXIS (ONLY FOR ANALOG TRACE)

Input connector	BNC	
Input impedance	10 kΩ	
Input coupling	dc	
Max input voltage	±10V	
Input voltage unblank	0.5V or less	See Note 1
Input voltage blanked	+ 2.4 V or more	See Note 1
Response time	80 ns	Rise time 2 ns

Note 1: Half tones are possible at input voltages between +0.8V and +2.4 V. Blanking has only effect on the trace in analog mode.

2.12 DISPLAY

2.12.1 CRT

CRT		
Deflection	Electrostatic	Vector
Dimensions (hxw)	80 mm x 100 mm	8 x 10 divisions
Phospor		
Standard	Green GH (P31)	
GRATICULE	Fixed	
Y-AXIS		
ORTHOGONALITY	90 ° ±0.5 °	
ACCELERATING		
VOLTAGE	16.5 kV	
Writing speed	>1.8cm/ns	
TRACE ROTATION		Screwdriver adjustment
Min. range	10 °	External field <0.1 mT
Min. overrange	2 °	
TRACE DISTORTION		
At center of screen	<0.3 mm	Deviation from straight line inside 6 x 8 div
Else	<1.0 mm	

2.12.2 Modes

PRESENTATION MODES	Y versus T Y versus X	

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.12.3 Vertical Display Manipulations (Digital Mode)

Linear		Linear interpolations between measured dots
Sine		Sine like interpolation between measured dots
Vertical magnify	2, 4, 8, 16, 32	
Windows	1, 2, 4	Each trace has his own place on the screen max. 4 traces
Recall trace		Each trace can be made visible on the screen or can be removed from the screen. Note 1
Vertical position	± 8 div	Each trace can be moved over 8 divisions
Max. displayable traces on screen	8	See Note 1

Note 1: At least one trace is visible.

2.12.4 Horizontal Display Manipulations (Digital Mode)

TIMEBASE MAGNIFICATION	2, 4, 8, 16, 32	See Note 1

Note 1: For acquisition depth greater than 512 byte it is possible to make the magnification factor less than one (compress mode) to display the complete trace on the screen.

2.13 EXTERNAL INTERFACES

2.13.1 Calibrator

WAVEFORM		
Shape	square wave	
INTERNAL IMPEDANCE		
Value	1200Ω	
OUTPUT VOLTAGE		
Peak-peak value	600 mV	See Note 1
Tolerance	1%	
OUTPUT CURRENT		
Peak-peak value	0.5 mA	See Note 2
FREQUENCY		
Value	2kHz	
Toierance	±20%	

Note 1: Positive going with respect to ground; Open voltage (halves when terminated with 1200Ω).

Note 2: When output short circuited (halves when terminated with 1200Ω).

2.13.2 Standard external interface

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
TYPE OF INTERFACE	RS 232-C	CPL (compact programming language) See operating guide
PINNING PIN	I/O NAME	
1	- -	Not connected
2	I RXD	Received data
3	O TXD	Transmitted data
4	O DTR	Data terminal ready
5	- GND	Signal ground
6	I DSR	Data set ready
7	O RTS	Request to send
8	I CTS	Clear to send
9	- -	Not connected
TRANSMISSION MODES	Asynchronous Full duplex	
HANDSHAKE		
Hardware	RTS/CTS and DSR/DTR	Default: not active See Note 1
Software	XON/XOFF	Default: not active See Note 1
BAUDRATE	75,110,150,300, 600, 1200,2000, 2400,4800, 9600, 19200,38400	Receiving and transmitting Default:1200 See Note 1
NUMBER OF STOP BITS	1	
PARITY	odd,even,or no	Default: no parity See Note 1
CHARACTER LENGTH	7 or 8	Default:8 See Note 1
ERROR RESPONSE	See CPL operating manual	
ELECTRICAL TXD and RXD		
Spacing "0"	≥ +3V	
Marking "1"	≤ -3V	
RTS,CTS,DSR and DTR		
ON	≥ +3V	
OFF	≤ -3V	
Current output	≤10mA	
Impedance		
Output	300Ω ±10%	
Input	≥3 kΩ ≤7kΩ	

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
Voltage Output Input	 ≥ -12V ≤ +12V ≥ -25V ≤ +25V	
Connector	Shielded	9 pole RAP male connector according MIL-C-24308

Note 1: Selectabele via UTIL- menu and CPL. When battery installed, same as last power-off value.

2.13.3 Optional external interfaces

IEEE	ANSI/IEEE 488.2	SCPI See section 2.20.5

2.13.4 Printers and plotters support

PRINTERS	HP-thinktjet LQ1500 FX80 HP-LASER
PLOTTERS	HPGL HP7440 HP7550 HP7475A HP7478A PM8277 PM8278

2.14 AUTO SET & CALIBRATION

2.14.1 Auto Set

AUTO SET selects the proper channel, sets vertical deflection, timebase speed, intensity, and triggering for an easy-to-read display of input signals, or the user programble AUTO SET items.

2.14.2 Calibration

CALIBRATION FACILITIES	Auto cal	See Note 1

Note 1: Calibrates vertical offset and gain, horizontal offset and gain and sweep time, trigger offset and gain.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.15 POWER SUPPLY AND BATTERY BACKUP

2.15.1 Power Supply

LINE VOLTAGE		
ac (rms)		
Operation	100V to 240V	
Tolerance	±10%	
LINE FREQUENCY		
Nominal	50 Hz to 400 Hz	
Limits of operation	45 Hz to 440 Hz	
LINE WAVEFORM CHARACTERISTICS		At nominal source voltage
Max. waveform		
Deviation factor	10%	
Crest factor	1.27 to 1.56	
ALLOWABLE POWER INTERTUPTION	20 ms	See Note 1
POWER CONSUMPTION		
Without options	115W	
Max. power consumption	130W	
POWER CORD		
Length	2.1m (82.7 in)	
Power plug	Nat.version	

Note 1: At the lowest allowable source voltage. After this time the oscilloscope data is saved before the instrument goes down, and an automatic power-on sequence starts after restoration of the power source voltage.

2.15.2 Battery Backup

DATA AND SETTINGS RETENTION		See Note 1
Retention time	2 years	
Batteries:		
Recommended type	LR 6	See Note 2
Quantity	2	
Temperature range	0..+70 °C	See Note 3

Note 1: When instrument is switched off or during power failure.

Note 2: According to IEC 285 (=Alkaline Manganese Penlight Battery), e.g. PHILIPS LR6 (9929 000 20734).

Note 3: At -40 to 0 °C, settings retention is uncertain. It is advised to remove batteries from instrument when it is stored during longer periods (>24 hours) below -30 °C or above 60 °C. UNDER NO CIRCUMSTANCES SHOULD BATTERIES BE LEFT IN THE INSTRUMENT AT TEMPERATURES BEYOND THE RATED RANGE OF THE BATTERY SPECIFICATION

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.16 MECHANICAL CHARACTERISTICS

PORTABLE VERSION		
Dimensions:		Handles excluded
Length	481 mm (19 in)	Add 5 mm (0.2 in) for cover Add 65 mm (2.5 in) for handle
Width	341 mm (13,5 in)	Add 50 mm (2 in) for handle
Height	139 mm (5,5 in)	Add 8 mm (0.3 in) for feet
Weight:		
Instrument	9.5 kg (19,7 lb)	
COOLING	Regulated Forced air	No air filter

2.17 ENVIRONMENTAL CHARACTERISTICS

2.17.1 General

The characteristics are valid only if instrument is checked in accordance with the official checking procedure. Warm up and recovery time are in accordance with MIL-T 28800D par. 3.7.1.1.

The instrument meets the environmental requirements of MIL-T-28800D Type III Class 3, Style D, Color R (unless specified otherwise).

2.17.2 Environmental

TEMPERATURE		See Note 1
Operating:		
min.low temp.	0 °C	
max.high temp.	+50 °C	
Nonoperating (storage):		
min. low temp.	-40 °C	
max. high temp.	+70 °C	
MAX. HUMIDITY		See Note 1
Operating and Non operating (storage)	95%	Relative humidity noncondensing
MAX. ALTITUDE		See Note 2
Operating	4.6 km (15000 ft)	See Note 3
Nonoperating (storage)	12 km (39000 ft)	
VIBRATION		
(OPERATING)		See Note 4
Freq. ranges:		g level at max. freq.:
	5 Hz to 15 Hz	0.7 at 15 Hz
	16 Hz to 25 Hz	1.3 at 25 Hz
	26 Hz to 55Hz	3 at 55 Hz

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
At each freq.range:		
Cycling time	15 min	
Resonance search	5 min	
Resonance dwell	10 min	See Note 5

Note 1: In accordance with MIL-T-28800D par. 3.7.2.1.1. (FIGURE 2).

Note 2: In accordance with MIL-T 28800D par. 3.7.3.

Note 3: Maximum operating temperature derated to 3 °C for each km above sea level

Note 4: In accordance with MIL-T-28800D par. 3.7.4.1.

Note 5: At each resonance frequency (or at 33 Hz if no resonance was found).

SHOCK (OPERATING)		See Note 6
Amount of shocks total	18	
each axis	6	3 in each direction
Shock waveform	half sinewave	
Duration	6-9 ms	
Peak acceleration	400 m/s^2	
BENCH HANDLING		See Note 7
Meets requirements of	MIL-ST-810 method 516 procedure V	
TRANSPORTATION	Drop height 0.76m	See Note 9
SALT ATMOSPHERE		
Structural parts		See Note 8

Note 6: In accordance with MIL-T-28800D par. 3.7.5.1.

Note 7: In accordance with MIL-T-28800D par. 3.7.5.3.

Note 8: In accordance with MIL-T-28800D par. 3.7.8.1.

Note 9: Drop in shipping container on 8 corners, 12 edges, 6 surfaces.

2.17.3 EMI

2.17.3.1 Meets MIL-T 28800D Type III Class 3 (Navy requirement, unless specified otherwise).

Meets MIL-STD-416C as follows:

-	Conducted Emissions	Part 2	CEO1	(Narrow band)
		Part 4	CEO3	
-	Conducted Susceptibility	Part 2	CSO1	
		Part 5	CSO6	(Limited to 300V)
-	Radiated Emissions	Part 5,6	REO1	
		Part 2	REO2	(1 GHz max)

2.17.3.2 VDE requirements

The instrument meets the requirements of VDE 0871 Grenzwert-klasse B.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.17.3.3 Additional EMI requirements

The instrument is tested in accordance with IEC 351-1 par. 5.1.3.1. The maximum deflection factor is 7 mm/mT (0.7 mm/gauss). This value measured with the instrument in a homogeneous field (in any direction with respect to the instrument) with a flux intensity (peak to peak value) of 1.42 mT (14.2 gauss) and of symmetrical sine wave form with a frequency of 45 Hz to 66 Hz.

2.18 SAFETY

MEETS REQUIREMENTS OF	IEC 348 Class I	See Note 1
	UL 1244	See Note 2
	CSA C22.2 No231	See Note 2
	VDE 0411	See Note 1
APPROVALS (applied for)	CSAC22.2 No231	
MAX. X-RADIATION	MIL-T-28800D par. 3.9.3.4.a	

Note 1: Except for power cord, unless shipped with universal European power cord.

Note 2: Except for power cord, unless shipped with North American power cord.

2.19 ACCESSORIES

PACKED WITH INSTRUMENT		
Signal input	2x10 MΩ 10:1 probe	With readout (1.5 m)
	Contrast filter	Blue
	Front cover	Can be locked on instr.
Operating guide		
Reference manual		

2.20 OPTIONS & OPTIONAL VERSIONS

2.20.1 Options Line cord

LINE CORD	Universal	
	European	In accordance with VDE
	North American	In accordance with CSA, UL
	United Kingdom	In accordance with BSI
	Australian	In accordance with SAA
	Swiss	In accordance with SAV

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.20.2 Options digital versions

EXTERNAL INTERFACES	IEEE	Factory installed only
INTERNAL EXTENSIONS	EXTENDED MEMORY	Factory installed only
	MATH+	Factory installed only

2.20.3 Options analog versions

EXTERNAL INTERFACES	Y-out, MTB gate, DTB-gate, MTB sweep	Factory installed only
	IEEE	Factory installed only

2.20.4 Specification optional outputs

Y SIGNAL OUT	BNC	
Source	CH1	
Coupling	as CH1	
Voltage:		
into 1 MΩ	20mV/div	
with a tolerance of	±10%	
into 50Ω	10mV/div	
with a tolerance of	±10%	
Freq. response	dc to ...	Terminated with 50Ω
Installed in PM3392/94	200 MHz	
Installed in PM3382/84	100 MHz	
Dynamic range	±10 div	At 50 MHz
MTB GATE OUT		
Connector	BNC	
Output impedance	1 kΩ	
Voltage:Timebase		
not running	0.2 ± 0.2V	
Timebase running	3.7 ± 1.3V	
MTB SWEEP OUT		
Connector	BNC	
Output impedance	1 kΩ	
Voltage:Timebase		
not running	0.0 ± 0.1V	
Timebase running	0.33V/div	
Error limit	±5%	
Linearity error	3%	
DTB GATE OUT		
Connector	BNC	
Output impedance	1 kΩ	
Voltage:Timebase		
not running	0.2 ± 0.2V	
Timebase running	3.7 ± 1.3V	

2.20.5 Specification IEEE-OPTION

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
TYPE OF INTERFACE	ANSI/IEEE 488.2	SCPI (see SCPI programming manual) See Note 1
INTERFACE REPERTORY		
Source handshake	SH1	Complete capability
Acceptor handshake	AH1	Complete capability
Talker	T5	Basic talker: yes Serial poll : yes Talk only : yes Unaddress if MLA: yes
Listener	L3	Basic listerner: yes Listener only : yes Unaddress if MTA: yes
Service request	SR1	Complete capability
Remote local	RL1	Complete capability
Parallel poll	PP0	No capability
Device clear	DC1	Complete capability
Device trigger	DT1	Complete capability
Controller	C0	No capability
ELECTRICAL INTERFACE		
Busdrivers	E2	Three state (true=0 to 0.8V; false=2 to 5V)
Connector	Shielded	Amphenol type 57FE-20240-20SD35
Pin 1 ... 4	DIO1...DIO4	
Pin 13 ... 16	DIO5...DIO8	
Pin 18 ... 23	GND	
Pin 24	Logic GND	
Pin 5	EOI	
Pin 6	DAV	
Pin 7	NRFD	
Pin 8	NDAC	
Pin 9	IFC	
Pin 10	SRQ	
Pin 11	ATN	
Pin 12	Shield	
Pin 17	REN	
FUNCTION SELECTION	Via UTIL-MENU	Busaddress Default: 8 See Note 2
INTERFACE STATUS INDICATOR	On screen	

Note 1: Talker/listener

Note 2: When battery installed, same as last power-off value.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION

2.20.6 Extended memory

If extended memory option is installed the paragraphs 2.2.5 (Time base delay digital mode), 2.9.4 (Trace memory) and 2.9.7 (Registers) must be replace by the next three paragraphs.

(2.2.5) Time base delay (digital mode)

TIME DELAY		
TRIGGER POSITION		
acquisition length normal	-10 to 0 div.	pretrigger
acquisition length max.	-640 to 0 div	pretrigger
DELAY	0 to 1000 div	posttrigger
Resolution	steps of 0.02 div	sample distance
EVENTS DELAY		
Range	1 to 16384	See event counter

(2.9.4) Trace memory

This digitizer has a total acquisition memory size of 32 kbyte. To apply this memory as efficient as possible it is shared by all channels connected to it. The following section summarizes the effects:

Record length normal		
1 to 4 channels selected	512 samples/channel	
Record length 'Max'		
1 to 4 channels selected	8k samples/channel	See Note 1
1 of 4 channels	32k samples	
Display	501 samples/trace	

Note 1: When peak detection or envelope is activated, all "max" record length figures have to be divided 2, because samples are stored as peak/peak combinations.

(2.9.7) Registers

NUMBER OF REGISTERS			Including current acq.
Acquisition length:			one set contains:
-Normal		51 sets	four traces
-Max:	-4 x 8k	3 sets	four traces
	-2 x 16k		two traces
	-1 x 64k		one trace
WORDLENGTH		16 bits	

3 DESCRIPTIONS

3.1 General description

3.1.1 Introduction to oscilloscope family

The family consists of four digital general purpose oscilloscopes with model numbers PM3382, PM3384, PM3392 and PM3394. All instruments have four vertical channels. Differences between these models are the vertical bandwidth, the features of the vertical channels 3 and 4 and the presence of switcheable 50Ω input impedance.

Vertical bandwidth is 100 or 200 MHz. The 'true 4 channel' oscilloscopes have four channels with a wide range of input sensitivities. Channel 3 and 4 in the '4 channel' versions offer the most commonly used input sensitivities (0.1 and 0.5 V/div). The table below explains the differences.

Model number	4 chann	true 4 chann	100 MHz	200MHz	Input impedance
PM3382	*		*		1 MΩ
PM3384		*	*		1 MΩ
PM3392	*			*	1 MΩ/50 Ω (CH1,2) 1 MΩ (CH3,4)
PM3394		*		*	1 MΩ/50 Ω

The printed circuit boards (units) and mechanical parts in this family of oscilloscopes have a high degree of standardization. The ordering codes for these parts are listed in chapter 4 'Parts'. In this chapter differences between PM3382, PM3384, PM3392 and PM3394 are mentioned.

3.1.2 Introduction to descriptions

Section 3.2 contains the description of the block diagram. The information in this diagram is presented in such a way that the link with the circuit diagrams in chapter 5 'Unit descriptions' can be found easily.

In chapter 4 'Parts' all general parts are described. These are, for example, the printed circuit boards (units), cables and mechanical parts that are not fixed to a specific unit. Cables are clearly identified on an interconnection diagram.

In chapter 5 the units are described in sequence of their number (A1, A2, A3, ...). Per unit the following information is given:

- Description
- Signal name list
- Unit lay-out (and location raster for the large units)
- Circuit diagrams
- Parts lists

3.1.3 Explanation of signal names

Throughout the circuit diagrams signal names are used. These names make it easier to trace a signal going from one circuit diagram to another. In many cases the signal name and also the component to which a certain node is connected are given in the circuit diagrams.

For every printed circuit board a signal name list is shown in alphabetical order. It shows:
- The meaning/function of the signal.
- The signal source(s).
- The signal destination(s).

Signal names are chosen up in a logical way. Basically signal names (e.g. MTBPPLEV-HD) consist of two parts:
- A functional part with a maximum of 10 characters (e.g. MTBPPLEV). The part is arranged such that recognition is easy.
- An extension with a maximum of 2 characters (e.g. HD). The extension is not always used.

The first characters (e.g. MTB) in the **functional part** indicate the part of the oscilloscope. Examples are:
- AT1, AT2, AT3, AT4: the input attenuators of channel 1, 2, 3, 4.
- PA1, PA2, PA3, PA4: the preamplifiers of channel 1, 2, 3, 4.
- FNC1, FNC2, FNC3, FNC4: the function selection parts of channel 1, 2, 3, 4. MTR: main time base triggering.
- MTB: main time base.
- DTR: delayed time base triggering.
- DTB: delayed time base.

The last set of characters in the **functional part** (e.g. PPLEV) indicates the function: in this example Peak-Peak LEVel triggering is switched on/off.

The first character of the **extension** indicates if the signal is active when high (H), active when low (L) or that this is not fixed (X, for instance the output of a counter).

The second character of the **extension** indicates the kind of logic. Possible abbreviations are: T (TTL), E (ECL), A (analog signal), C (CMOS 12 ... 15V) and D (CMOS 5V).

3.1.4 Voltage values in the circuit diagrams

Throughout the circuit diagrams voltage values are indicated. This facilitates fault finding in the vertical channels, triggering, time base and final amplifiers. Most of the voltages consist of an AC signal superimposed on a DC biasing voltage. Some of the AC voltages are small. They must be measured with an oscilloscope via a 1:1 probe and AC coupled input. The DC signal component is bigger and must be measured with the measuring oscilloscope with DC coupled input. The nodes where a signal can be measured are indicated with a dot on the p.c.b. lay-outs.

The oscilloscope under test must be prepared as follows:
- Connect the CAL voltage via a 10:1 probe with indication ring to the input of the suspected channel.
- Press the STATUS and TEXT OFF key simultaneously to get a defined starting position.
- Press the AUTOSET key.
- Put AMPL/VAR of the active channel to 0.1 V: this should give 6 vertical divisions of signal on the screen.

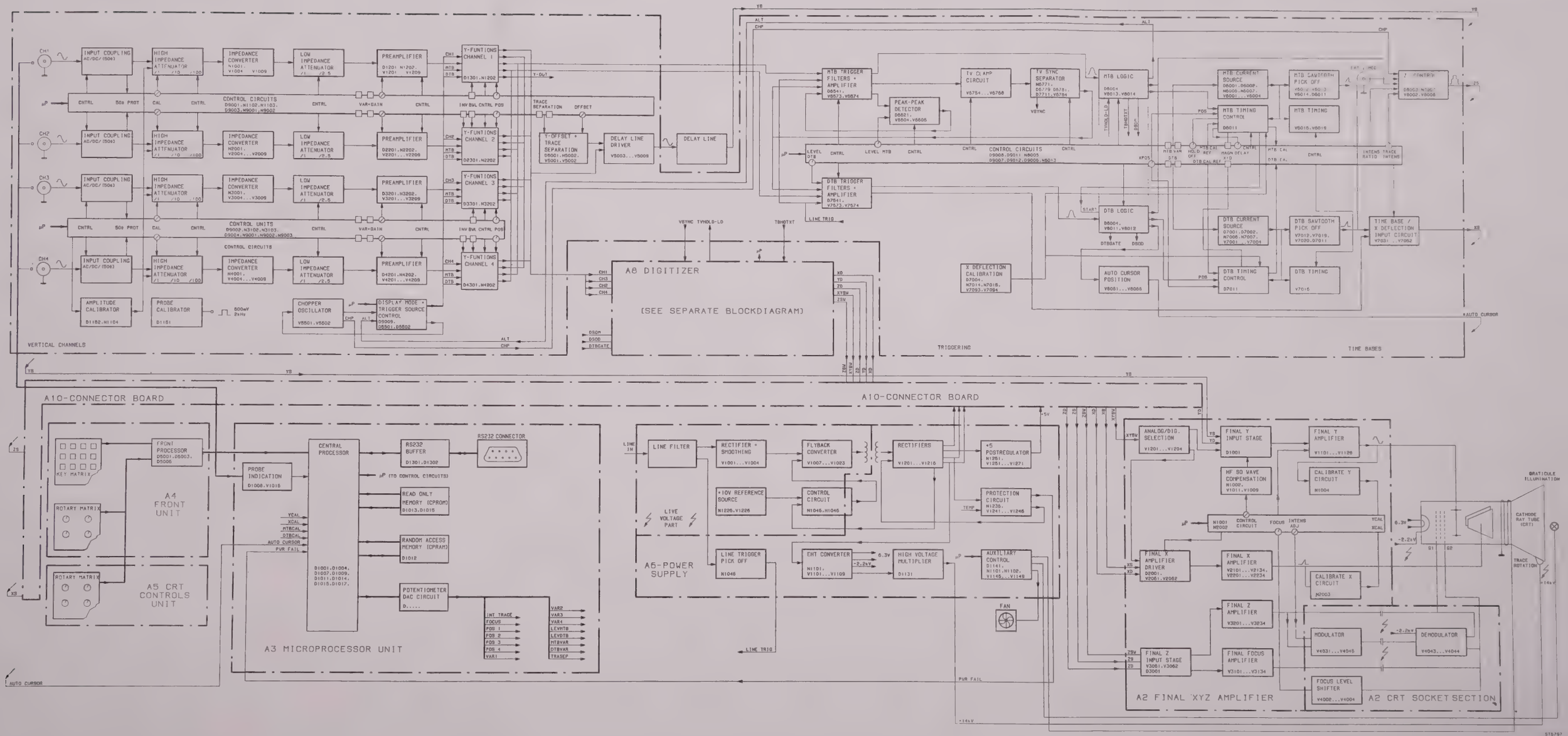


Figure 3.2 Blockdiagram, Analog part

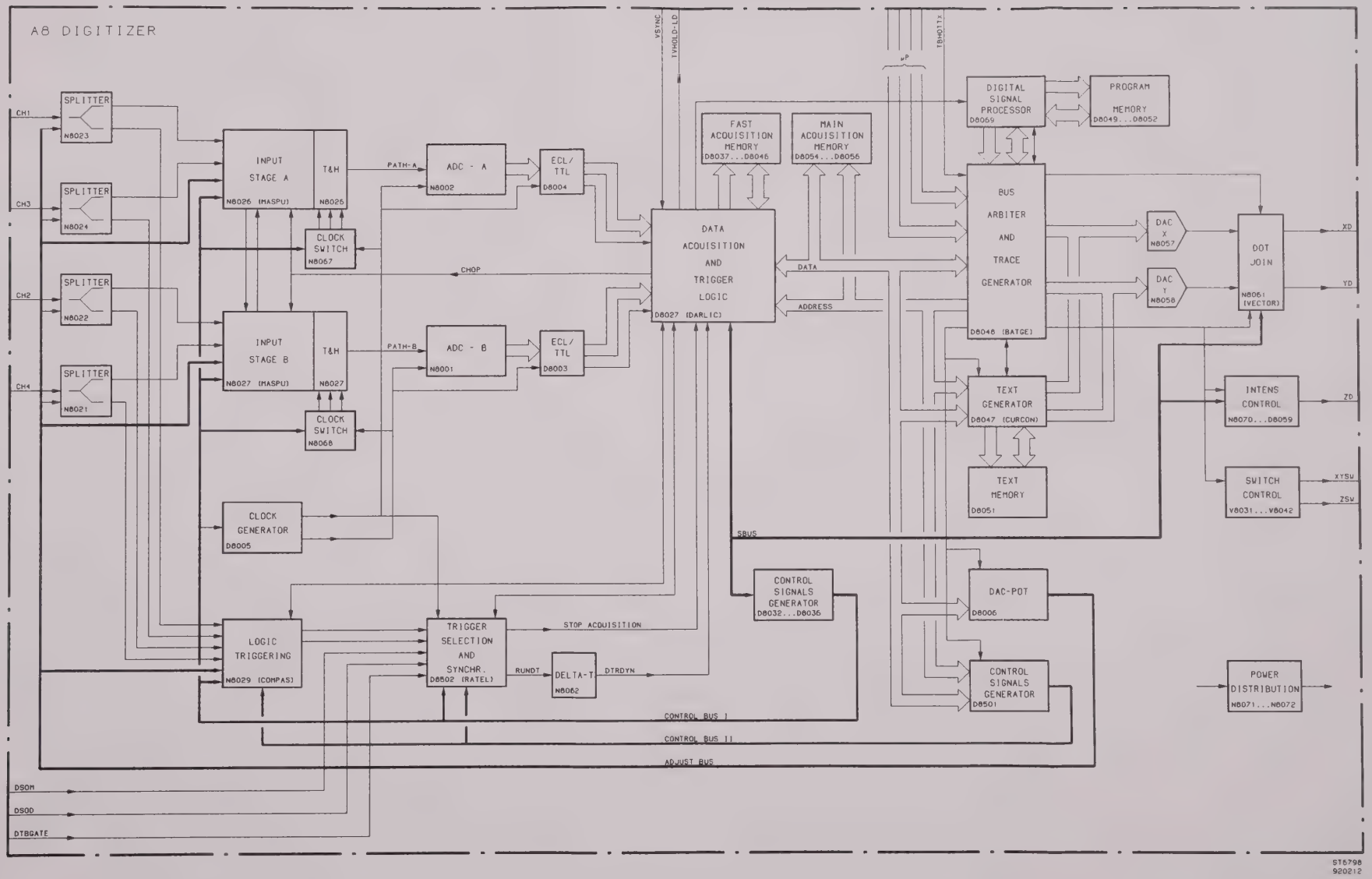


Figure 3.2 Blockdiagram, Digital part

Some important notes:
- To measure some signals, it is necessary to unlock units. Refer to chapter 8.5 for details on how to proceed.
- The given AC and DC signals are average values: your oscilloscope under test may deviate from the values given in the circuit diagrams. 100 MHz clock signals and fast switching signals on the digitizer unit A8 require a measuring oscilloscope with a bandwidth of 200 MHz or more.
- Although the oscilloscope is in standard setting, it may be necessary to do manual selections for certain measurements. To measure e.g. the delayed time base and its triggering, it is necessary to activate DTB and to select a channel as DTB trigger source.The same is valid for digitizer functions like logic pattern, timed pattern, double sampling speed (250 ns/div).
- When measuring in the final amplifiers, it advised to switch off all text. This gives 'cleaner' signals at the outputs. The text is written inbetween the signal at a random basis.
- Measuring the outputs of the final Y amplifier must be done with a 10 kΩ resistor between probe tip and signal. This avoids oscillations.
- Refer to chapter 8.11.4.7 (Repair tools/DAC) on how to check the range of DAC-generated adjustment voltages.

3.2 BLOCK DIAGRAM DESCRIPTION

3.2.1 Introduction

This block diagram and description are based upon the most complex version of this family of digital oscilloscopes. Therefore there may be minor differences between your oscilloscope and the block diagram and its description. Where differences may occur it is mentioned in the text.

The item numbers of active components are indicated each block of the diagram. This facilitates to make the link with the circuit diagrams.

The oscilloscope is controlled by a microprocessor that connects to many blocks. Therefore throughout this block diagram CONTROL CIRCUITS can be found that are controlled by the microprocessor. The output signals can be simple on/off signals e.g. to switch a certain vertical channel on and off. There are also adjustable dc voltages e.g. to determine the gain of a vertical channel. Blocks that are under control of the microprocessor have the input signal "µP". In the vertical, horizontal and time base sections, circuits are added for microcomputer controlled automatic calibration.

This description is divided according to the functional blocks that can be distinguished:
- Vertical channels: there are 4 vertical channels.
- Triggering and time bases: there are sections for main- and delayed time base.
- Final amplifiers: for vertical (Y) and horizontal (X) deflection, intensity (Z) and focusing control.
- Front unit and microprocessor unit.
- Power supply unit.
- Digitizer unit.

Also the printed circuit boards (units) are indicated in the blockdiagram. These units are:
- Signal unit A1: is the largest of all and incorporates 4 vertical channels and main- and delayed triggering and time base.
- Final XYZ amplifier A2: all final amplifiers are present here. A separate part is connected to the CRT socket.
- Microprocessor unit A3.
- Front unit A4: incorporates most of the rotary knobs and keys.
- CRT controls unit A5: incorporates the rotary knobs for the display functions.
- Power supply unit A6: supplies various voltages to the other circuit boards.
- Digitizer unit A8: includes all digital storage circuitry.
- Motherboard A10: many signals are routed via this unit.

3.2.2 Vertical channels

There are 4 vertical channels that are mainly identical. A difference is that the 200 MHz oscilloscope versions have a switchable 50Ω input impedance while the 100 MHz types do not have this feature. Another difference is between the 4 channel and the 2 + 2 channel versions. The 4 channel scopes have 4 identical vertical channels (CH1, CH2, CH3 and CH4) with an extensive range of input sensitivities. The various input sensitivities are made by combinations of settings of HIGH IMPEDANCE ATTENUATOR, LOW IMPEDANCE ATTENUATOR and PREAMPLIFIER.
The 2 + 2 channel versions have 2 identical vertical channels (CH1 and CH2) with an extensive range of input sensitivities. The other 2 channels (CH3 and CH4) are identical and have 2 switchable input sensitivities. Channel 1 operation and the differences with channels 2, 3 and 4 are now explained.

The CH1 input signal is applied to the INPUT COUPLING block. Here selection between ac or dc coupled input is done. Moreover in the 200 Mhz oscilloscopes selection between 50Ω and 1 MΩ input impedance is done here. A signal 50Ω PROTection signals via the CONTROL CIRCUITS to the microprocessor if the dissipation in the 50Ω termination resistor gets too high.

The block HIGH IMPEDANCE ATTENUATOR incorporates the attenuation coefficients /100, /10 and /1. This block has a fixed attenuation in channels with 2 input sensitivities such as present in the 2 + 2 channel oscilloscopes. The input signal originating from the AMPLITUDE CALIBRATOR is used to automatically calibrate the vertical channels. The AMPLITUDE CALIBRATOR is a generator that can deliver 8 different accurate voltages. The HIGH IMPEDANCE ATTENUATOR also comprises a high-frequency square-wave adjustment; this is done by adjustment of dc signal CAL.

The IMPEDANCE CONVERTER converts the input signal at high input impedance into an output signal at a low impedance. This block is followed by a LOW IMPEDANCE ATTENUATOR that makes the attenuation coefficients /2,5 and /1. This block has a fixed attenuation in channels with 2 input sensitivities such as present in the 2 + 2 channel oscilloscopes.

The PREAMPLIFIER incorporates gain/attenuation coefficients x1, x5, /2 and also continuous GAIN control via a microprocessor adjustable dc signal. The PREAMPLIFIER is followed by Y-FUNCTIONS CHANNEL 1. In this block the selection is achieved of vertical display via channel 1, Main Time Base (MTB) triggering via channel 1 and Delayed Time Base (DTB) triggering via channel 1. Also the filter for the Bandwidth Limiter (BWL), the vertical position control (POS) and an output to the digitizer (EXT). From Y-FUNCTIONS CHANNEL 1 the signal for the Y- OUTput socket is derived. The Y-FUNCTIONS blocks of channel 2 and 4 have an INVert function for signal inversion.

The selection of the vertical channel, MTB and DTB trigger source is initiated by the block DISPLAY MODE + TRIGGER SOURCE CONTROL. The channels and trigger sources to be displayed are controlled by the microprocessor (μP). In ALTernate display mode the switching between channels/trigger sources occurs at the end of the MTB sweep. The signal ALT controls this. For the vertical display mode CHOPpped a 2MHz CHOPPER OSCILLATOR is present. Display blanking during switching from one channel to another is done via signal CHP.

The selected vertical channel(s) are applied to the DELAY LINE DRIVER. This block is an amplifier that has the correct output impedance to drive the DELAY LINE. The DELAY LINE itself consists of a coaxial cable giving sufficient signal delay so that propagation delay in the trigger circuits is compensated. Because of this leading edges of fast-rising pulses can be made visible. The Y-OFFSET + TRACE SEPARATION block can influence the offset of the signal applied to the DELAY LINE DRIVER. This is used as offset compensation and also for TRACE SEParation in ALTernate Time Base mode.

The PROBE CALIBRATOR is a generator delivering a 2kHz/600mV square- wave signal. This signal can be used to adjust the square-wave response of attenuator probes.

3.2.3 Triggering and time bases

The sections for Main Time Base (MTB) and Delayed Time Base (DTB) are for the greater part identical. Therefore the MTB part is extensively described and then the DTB part briefly.

Main Time Base Description.
The possible trigger sources are applied to the block MTB TRIGGER FILTERS + AMPLIFIER. The selection for triggering on the vertical channels 1, 2, 3 or 4 is done in the Y-FUNCTIONS blocks in the vertical section. Triggering is also possible on the LINE trigger signal that is derived from the mains. The MTB TRIGGER FILTERS + AMPLIFIER incorporates filters for HF- reject, LF-reject and ac or dc signal coupling. The block also incorporates the +/- slope selection. The dc control signal LEVEL MTB originating from the CONTROL CIRCUITS is routed via the PEAK-PEAK DETECTOR. This block limits in peak-peak mode the LEVEL MTB range just within the peak-peak value of the signal. For this purpose the trigger signal is applied to an input of the detector. The LEVEL MTB control signal is not limited if the peak-peak mode is inactive.

For triggering on TV synchronization pulses the blocks TV CLAMP CIRCUIT and TV SYNC SEPARATOR are used. The CLAMP CIRCUIT separates the synchronization pulses from the composite video signal. The video information is not necessary for triggering. The TV SYNC SEPARATOR filters out line, frame and field pulses. This is done for various TV systems including HDTV. A VSYNC output is connected to digitizer unit A8.

The block MTB TRIGGER FILTERS + AMPLIFIER sends trigger pulses to the MTB LOGIC. This logic is combined with the DTB LOGIC. The three output signals are used to start MTB (applied to MTB TIMING CONTROL), to switch intensity on and off (applied to Z CONTROL) and for ALTernate display switching (applied to DISPLAY MODE + TRIGGER SOURCE CONTROL). TV HOLD-LD is received from digitizer A8. TB40TXT and MTB trigger DSOM are applied to A8.

The MTB is based on the principle that selectable capacitors (inside block MTB TIMING) are charged with a selectable constant current (from MTB CURRENT SOURCE). This results in a sawtooth voltage across the capacitor(s) that rises linearly with the time. As a consequence a time-linear horizontal deflection is obtained. The sawtooth voltage is routed to the horizontal deflection part via the MTB SAWTOOTH PICK OFF. This block serves as a high to low impedance converter so that the load to the timing capacitor(s) is minimal. Various time base sweep speeds are obtained by selecting different combinations of current values and timing capacitors. The function MTB VARiable works via the MTB CURRENT SOURCE.

The MTB TIMING CONTROL discharges the capacitor(s) if the maximum level of the sawtooth is reached. The MTB TIMING CONTROL allows the charging process to start again if a trigger occurs. The functions X POSition, HOLD OFF and 10x MAGN are applied to and realized in the MTB TIMING CONTROL. HOLD OFF determines the time between discharge of the timing capacitors and the moment that a trigger pulse is allowed to start the MTB again.

The MTB TIMING CONTROL accomplishes the DELAY time function. The sawtooth voltage is compared with an adjustable dc voltage. The DTB is started where both voltages have the same level: this condition is signalled to the DTB LOGIC via signal START.

The MTB TIMING CONTROL also plays a role in the automatic MTB calibration. A reference voltage MTBCALREF is compared with the sawtooth voltage. The time necessary for the sawtooth to reach the MTBCALREF level is monitored by the microprocessor via signal MTBCAL. If necessary the MTB is readjusted. Automatic calibration of the X-path (including output circuit of MTB TIMING CONTROL) is done with accurate voltages from the block X DEFLECTION CALIBRATION.

Delayed Time Base Description.
The function of DTB TRIGGER FILTERS + AMPLIFIER is identical to the corresponding block in the MTB part. A "peak-peak detector" for LEVEL DTB is not present. The range of this control is always fixed and not related to the peak-peak level of the signal. Blocks for TV triggering are not present in the DTB section. TV triggering of the DTB occurs via output signals from the TV SYNC SEPARATOR in the MTB section.

An output signal from DTB TRIGGER FILTERS + AMPLIFIERS can be used for X DEFLection (MTB and DTB are off then) via the block TIME BASE / X DEFLECTION INPUT CIRCUIT.

The function of DTB CURRENT SOURCE, DTB TIMING and DTB SAWTOOTH PICK OFF is identical to the corresponding blocks in the MTB section. For the DTB LOGIC there is an extra input signal START to start the DTB directly after the adjusted delay time. The START signal originates from the MTB TIMING CONTROL. DTB GATE and DTB trigger DSOD are applied to A8.
The block AUTO CURSOR POSITION is used to position the voltage cursors automatically on the top and bottom level of the signal. The top and bottom levels are detected via the DTB triggering: the microprocessor scans the waveform by successively changing the DTB LEVEL and checking if triggers are still detected. Automatic calibration of the X-path (including output circuit of DTB TIMING CONTROL) is done with accurate voltages from the block X DEFLECTION CALIBRATION.

The DTB TIMING CONTROL is simpler than the corresponding block in the MTB. The functions DELAY and HOLD OFF are not present. DTB uses the MTB hold off time. This is due to the fact that the DTB can not run while the MTB does not.

X deflection selection and intensity control.
The block TIME BASE/X DEFLECTION INPUT CIRCUIT permits selection between horizontal deflection via MTB/DTB or via a signal selected via the DTB triggering (X DEFL mode).

The block Z-CONTROL controls the intensity of the signal on the screen. This also affects the focusing. Signal intensity and the intensity of text is determined in the final amplifier section.

The signal intensity is determined by the MTB LOGIC (light on/off) and DTB LOGIC (intensified part during run of DTB). The ratio between intensity of MTB and DTB is determined by control signal INTENS RATIO. Input signal CHP gives display blanking in vertical display mode chopped when switching from one channel to another. The control signal TRACE INTENS is influenced by the control with the same name. Intensity can also externally be controlled via input socket EXT Z MOD.

3.2.4 Final amplifiers

The final amplifier can be split up in parts for vertical (Y) and horizontal (X) deflection and parts for intensity (Z) and focusing control. Input signals originate from the analog as well as the digital vertical (Y) channels and time bases (X). The signals that determine X, Y and Z of the text originate from the text generator on the digitizer unit. The signal that switches between analog and digital (XYSW signal) display originates also from the digitizer. The outputs of the final amplifiers drive the Cathode Ray Tube (CRT). The various sections are explained now in sequence.

Vertical deflection.
The FINAL Y INPUT STAGE receives input signal for signal display (YS) from the DELAY LINE. A second input signal (YD) determines the vertical component of the digital trace and text information. The input signal that comes from AN/DIG SELECTION controls switching between analog and digital display. The HF SQ WAVE COMPENSATION is controlled by the microcomputer provides that signal distortion from the DELAY LINE is compensated in the FINAL Y INPUT STAGE. The FINAL Y AMPLIFIER drives the vertical deflection plates of the CRT. The voltage applied to these plates is measured by the block CALIBRATE Y CIRCUIT. Its output signal YCAL is applied to the microprocessor; this is part of the automatic vertical calibration facility.

Horizontal deflection.
The FINAL X AMPLIFIER DRIVER receives input signal for signal display (XS) from the Main and Delayed Time Base sections. A second input signal (XD) determines the horizontal (X) component of the digital trace and text information. The input signal that comes from AN/DIG SELECTION controls switching between analog and digital display. The FINAL X AMPLIFIER drives the horizonal deflection plates of the CRT. The voltage applied to these plates is measured by the block CALIBRATE X CIRCUIT. Its output signal XCAL is applied to the microprocessor; this is part of the automatic horizontal calibration facility.

Intensity and focusing.
The FINAL Z INPUT STAGE receives input signal for trace intensity (ZS) from the Z CONTROL block in the time base section. A second input signal (ZD) determines the intensity (Z) component of the text information. An input signal ZSW that comes from the digitizer allows switching between analog and digital intensity. The FINAL Z AMPLIFIER drives the intensity control electrode G1 of the CRT. This electrode is at a very negative -2.2kV voltage level. It is for that reason that a high-voltage blocking capacitor is necessary between G1 and the output of the FINAL Z AMPLIFIER. However only the ac component in the signal can pass through the capacitor. The dc and lf components are applied to the MODULATOR and modulated on a high-frequency carrier. Now they can pass through a capacitor, are demodulated in the DEMODULATOR and then the dc, lf and hf components are recombined.

The FINAL Z INPUT STAGE drives, in parallel with the FINAL Z AMPLIFIER, the FINAL FOCUS AMPLIFIER. This has the result that a well-focused spot over a large intensity range is obtained. The FINAL FOCUS AMPLIFIER drives the intensity control electrode G3 of the CRT. This electrode is at a very negative -2.2kV voltage level. It is for that reason that a high-voltage blocking capacitor is necessary between G3 and the output of the FINAL FOCUS AMPLIFIER. The ac component in the focusing signal passes through a high-voltage capacitor. The lf and dc components are derived from the DEMODULATOR that is also used in the intensity part. Focus control is possible via the FOCUS LEVEL SHIFTER.

3.2.5 Front unit and microprocessor

The front unit and microprocessor are the sections where all oscilloscope functions are controlled. Also the generation of text and the automatic calibration is controlled by the microprocessor. The operations performed by the microprocessor are determined by the ROTARY MATRIX and KEY MATRIX. Also commands from an external computer connected to the RS232 connector have the same result.

The ROTARY MATRIX and keys in the KEY MATRIX present at front unit A4 are read by the FRONT PROCESSOR. Also the ROTARY MATRIX that is present on the CRT controls unit A5 is read by the FRONT PROCESSOR. The CENTRAL PROCESSOR on the MICROPROCESSOR UNIT A6 is informed by the FRONT PROCESSOR of the settings selected with the front panel controls. Incorporated in the CENTRAL PROCESSOR is a complete RS232 interface. Serial communication is possible via the RS232 BUFFER.

The CENTRAL PROCESSOR has many inputs and outputs and forms the heart of the oscilloscope's control section. First of all there are a READ ONLY MEMORY (CPROM) and a RANDOM ACCESS MEMORY (CPRAM). The POTENTIOMETER DAC CIRCUIT is able to produce 16 independently adjustable dc voltages. These voltages are used for continuous controllable functions such as POSition, FOCUS and VARiable.

The CENTRAL PROCESSOR also has a number of analog inputs that are internally converted into digital. These inputs are used for automatic calibration (YCAL, XCAL, MTBCAL and DTBCAL), AUTOCURsor position, power fail and probe indication (via PROBE DETECTION block). An important output is the "µP" output. It is via this output that the CONTROL CIRCUIT blocks found throughout the block diagram are controlled.

The CENTRAL PROCESSOR communicates to the TEXT/CURSOR CONTROL which text and cursors have to be displayed. This information is stored in the TEXT/CURSOR MEMORY.

3.2.6 Power supply

The power supply is a switched mode type and has high efficiency. It can function on a wide range of LINE input voltages. An important part of the power supply is directly connected to the mains. This part carries LIVE VOLTAGE and measurements and repairs must be carried out via a separation transformer by a qualified technician.

The LINE IN voltage is applied to the LINE FILTER. This block prevents line interference from entering the supply unit. Also interference generated by the power supply does not enter the mains. An output signal of the filter is applied to the LINE TRIGGER PICK OFF in order to facilitate line triggering of the time bases.

The other output signal is applied to RECTIFIER + SMOOTHING: the output of this block has a dc voltage of which the height depends on the applied line voltage. This dc voltage is applied to the FLYBACK CONVERTER. This block incorporates a high voltage switching element that converts the dc voltage into a high-frequency ac voltage. This ac voltage is applied to the primary winding of a transformer. The secondary winding has many taps with connected RECTIFIERS: this gives the required supply voltages for the oscilloscope. The +5V POSTREGULATOR gives additional stabilization of the +5V supply voltage.

Stabilization of the output voltages at different line voltages is achieved by varying the on/off ratio of the switching element in the FLYBACK CONVERTER. The on/off ratio is determined in the CONTROL CIRCUIT by comparing the accurate output voltage of the +10V REFERENCE SOURCE and an output voltage of the RECTIFIERS.

The EHT CONVERTER generates the 6.3V heater voltage and -2.2kV cathode voltage for the Cathode Ray Tube (CRT). The +14kV final accelerator voltage for the CRT is generated in the HIGH VOLTAGE MULTIPLIER.

The AUXILIARY CONTROL is controlled by the microprocessor (µP) and generates three dc voltages that are used for TRACE ROTATION adjustment, GRATICULE ILLUMINATION adjustment and speed control for the FAN.

The PROTECTION CIRCUIT switches the power supply off in case of over and under output voltage, too low line voltage and too high temperature.

3.2.7 Digitizer

Blockdiagram description of the digitizer unit A8, which contains all digital storage circuits of the oscilloscope.

Main sections of the digitizer are:
- Input Stage
- Analog to Digital Converter and Clock Generator
- Control-signal Generator
- Trigger Comparator, Source Selector and Delta-t circuit
- Data Acquisition and Trigger Logic and Fast Acquisition Memory
- Main Acquisition Memory
- Digital Signal Processor and Program Memory
- Bus Arbiter and Trace Generator
- Text Generator and Text Memory
- X- and Y- Output DAC, Dotjoin circuit and Intensity Control

The digitizer unit contains a large number of integrated circuits that consists of a large amount of functions. It is not possible to measure around inside these circuits and therefore a detailed description of the functions in these integrated circuits is not given.

The functioning of the digitizer is explained using a separate blockdiagram.

In the blockdiagram description as much links as possible are made to the different components in the circuit diagrams and their item numbers.

3.2.7.1 Input stage

Four input channel signals for channels 1, 2, 3, and 4 from the analog oscilloscope section are applied to the digitizer unit via eight coaxial cables. Each of these symmetrical input channel signals is splitted in two equal signals by a signal buffer and SPLITTER.
One signal is going to an INPUT STAGE into the vertical signal data path, the other signal is supplied to pattern and state comparators in the LOGIC TRIGGERING block in the trigger signal path.

The MASPU's (Main Analog Signal Processing Unit) A and B take care of the channel switching.
The input channel signals 1 and 3 are limited and amplified to be multiplexed by the chopper circuit in MASPU-A. The same for input channel signals 2 and 4 in MASPU-B.
The multiplexed signal is amplified and split in two equal parts again. Part one is fed to a combiner in MASPU-A. Part two is fed to the combiner in the other MASPU-B.
Each channel combiner has two modes, selected by control signals.
In the first mode it supplies its own signal to a variable gain circuit and in the second mode it supplies the signal from the other MASPU to the variable gain circuit.
Via the VAR control circuit the vertical gain information for each path is applied to the circuit.
The output signal from each variable gain circuit is converted into an asymmetric signal, that is fed to a Track and Hold circuit T&H. This circuit is needed to offer a stable input signal to the analog to digital converter behind it. The T&H control signal is a 100MHz clock.

3.2.7.2 Analog to Digital Converter and Clock Generator

The T&H circuit offers a stable input signal to an analog to digital converter (ADC).
Both the ADC-A and the ADC-B are under all circumstances continuously clocked by a 100 MHz clocksignal which is generated by a CLOCK GENERATOR. The ECL output data signals of the ADC's are buffered and converted into TTL data signals by ECL/TTL translators.

3.2.7.3 Control-signal Generator

A number of control, mode and selection signals come from CONTROL SIGNAL GENERATORs via an SBUS (serial bus interface) and a serial to parallel converter. These control signals have functions in almost all circuits.

3.2.7.4 Trigger Comparator, Source Selector and Delta-t circuit

Acquisition of new signal information is stopped on receipt of an active trigger and this is completely controlled by the fully programmable trigger circuits. The time relation between the freezeing of the acquisition and the signal STOPACQ depends on the choosen trigger delay.

The trigger signal path provides for three additional trigger modes to the modes which are already present in the analog front end. It are Pattern triggering, Timed-Pattern triggering and State triggering.

The four input channel signals from the buffers and SPLITTERs are applied to four level comparators in the LOGIC TRIGGERING block.
They are compared to a user-defined pattern in a Pattern and Edge selector. When the user-defined pattern conditions are met, an internal PATTERN signal becomes active and is applied to the TRIGGER SELECTION and SYNCHRONIZATION circuit, to Timer circuits and to Timed Pattern and State circuits.

The trigger source selector will select the trigger signal, corresponding with the user-defined trigger mode.

Signals as Main Time Base trigger DSOM, Delayed Time Base trigger DSOD and DTBGATE are derived from the trigger circuits in the analog oscilloscope section.

Trigger selection, mode selection, pattern and control signals are generated via the serial bus interface and a serial to parallel converter. Events clock selection is controlled in the same way.

With events selected, the trigger detection unit catches the first edge. With this edge it enables an event counter in the DATA ACQUISITION AND TRIGGER LOGIC.
When it has finished counting the required number of events, a second stage in the trigger detection unit is enabled to catch the last event clock.

In TV trigger mode the events clock is switched to DSOM. By enabling the event counter with VSYNC (derived from the composite sync signal on DSOM) it is posible to count down with the events counter to any line in a TV signal. In digital mode the events counter is loaded with a count value one less than necessary. Now the trigger sync unit can generate a trigger on the correct TV line. In analog mode the events counter output is fed back to the analog front end as TVHOLD-LD.

In normal trigger mode the event counter is enabled by a signal from the data path. Now we can count trigger pulses for trigger delay activities during the acquisition.

A signal RUNDT is derived from the trigger circuit to start a delta-t measurement by a DELTA-T circuit. This circuit is used to measure the time elapsed between the moment of triggering and the real sample moment. It is a measure to determine the correct location in memory to store the digital code of the first sample of each acquisition cycle.
A DELTA-T counter in the DATA AND ACQUISITION TRIGGER LOGIC is running at the maximum sample clock frequency, enabled by the STOPACQ (stop acquisition) signal. Counting is stopped by the falling edge of the delta-t ready signal DTRDYN from the DELTA-T circuit.

A digital signal processor (DSP)is informed about this completion of the delta-t measurement by an interrupt signal. It then reads the value of the measurement in the DELTA-T counter and it resets the counter to zero again in order to be ready for the next DELTA-T measurement. The measurement is very important for the positioning of the sample in memory as well as on the CRT screen.

3.2.7.5 Data Acquisition and Trigger Logic and Fast Acquisition Memory

The output data from the ECL/TTL translators is applied to the DATA ACQUISITION AND TRIGGER LOGIC circuit (DARLIC), which contains a data path and a trigger engine. The data path is responsible for the total acquisition process from ADC to memory, including time-base generation and the trigger engine is responsible for the generation of a start/stop acquisition signal that is fed to the data path.

The data is latched by a register and checked on over/underflow by a detector.
Peak detectors determine minimum and maximum values of the signal. When peak is off, this circuit will pass on all the samples. A data junction lowers the data rate from 100 MHz streams to eight 25MHz data streams and guides the data from the peak circuit properly to output latches.

Data will directly be stored in a FAST ACQUISITION MEMORY (FAM) which consists of 8x a 2kx8 bit SRAM.

The FAM is addressed by two 18 bit wide address pointers, the acquisition pointer and the display pointer.

The acquisition pointer is active during the writing of new signal data information into the FAM. The write cycle starts, if enough bytes have been received. The pointer is loaded by the digital signal processor with the address of the first sample of a display cycle.

FAM data is read, 64 bits at a time, when no write actions are performed and enough time-space is available between two write actions of the acquisition path. The FAM is then addressed by the display pointer, which is automatically presetted with the address where the display should start. A kind of handshake control is responsible for correct operation.

The acquisition control logic separates the time around the trigger point in, gathering of pre- and post trigger information, and the counting down of a specific extra trigger delay.

The SBUS (serial bus interface) is part of the DARLIC circuit. It is supporting a very limited number of capabilities. Its register is controlling two open collector I/O pins, SDA (serial data) and SCL (serial clock), and a select line SSEL. The buffer enables the DSP to read the status on the SDA and SCL lines.

The SBUS is connected to a CONTROL SIGNAL GENERATOR, the DOT JOIN circuit and to the INTENSITY CONTROL circuit.

All interrupt sources within DARLIC's data path, trigger path, and other features are gathered in the interrupt register.

The DSP can write an interrupt mask into the interrupt enable registers. There are two interrupt enable registers, so that different interrupt causes can generate interrupts with different destinations. Bits in these registers that are set, enable the corresponding bit in the interrupt register to generate an interrupt.
Every bit in the interrupt register can be cleared separately by the interface clear control. They can also automatically be cleared upon a read of the interrupt register via the interrupt status buffer.

3.2.7.6 Main Acquisition Memory

The converted analog signals are stored directly from the ADC's into a FAST ACQUISITION MEMORY. Acquired data has later to be transferred to a MAIN ACQUISITION MEMORY (MAM) by means of a DIGITAL SIGNAL PROCESSOR (DSP). The MAM consists of 2x a 32kx8 bit SRAM, is non volatile and contains all trace registers. It contains an acquisition memory part as well as a display memory part and contains the data which is ready for display on the CRT screen.

3.2.7.7 Digital Signal Processor and Program Memory

The DIGITAL SIGNAL PROCESSOR (DSP) has the control over the entire DIGITIZER and performs all necessary signal processing activities, which are not available in hardware.
Signal processing functions are functions like:

- Pre-processing: Average, envelope
- Postprocessing: Mathematical functions, interpolation, filters
- Other functions: Display memory refresh, X-position control, delta-t processing and so on

One of its main tasks is the composition of the trace information out of the available registers. The SYSTEM ENGINE is responsible for the text data.
The Text and Trace Generator takes care of generating the appropriate X, Y and Z information for the vector oriented CRT.

Although the DSP has full control over the DIGITIZER the SYSTEM ENGINE is able to access all circuits in the same way.

At any point in time, the DIGITAL SIGNAL PROCESSOR can force an exit to the idle state. Under certain conditions the DSP can force a change from state three to state four.
The DSP can also write an interrupt mask into the interrupt enable registers.

The DSP uses its own PROGRAM MEMORY which consists of 2x an 8kx8 bit SRAM. It is a volatile memory and can not be accessed by any other device.

3.2.7.8 Bus Arbiter and Trace Generator

The major function of the BUS ARBITER AND TRACE GENERATOR (BATGE) is the arbitration between multiple processors, multiple memories and memory mapped I/O with a minimum of interference.
Wait cycles for memory devices are programmable and active devices like the DARLIC circuit for example, generate a "not ready signal".

The BATGE circuit is also responsible for interconnecting all address, data and control busses of the DSP, SYSTEM BUS, TEXT AND TRACE GENERATOR, DARLIC and MAM.

The eight traces are generated by the TRACE GENERATOR in the BATGE circuit.

3.2.7.9 Text Generator and Text Memory

The SYSTEM ENGINE is responsible for the text data and the Text and Trace Generator takes care of generating the appropriate X, Y and Z information in vector notation for the vector oriented CRT.

Text and cursor information to be displayed on the CRT screen, is stored in a TEXT MEMORY which consists of one 8kx8 bit SRAM circuit.

3.2.7.10 X- and Y- Output DAC, Dotjoin circuit and Intensity Control

Digital signal and text data from the MAM display part, to be displayed on the CRT screen, is via the BATGE circuit applied to the digital to analog converters DAC X and DAC Y where it is converted into analog signals. They pass a DOTS/DOTJOIN circuit and are fed to the final X- and Y- amplifier stages in the analog oscilloscope section. A switch signal for switching between analog oscilloscope operation and digital oscilloscope operation is generated by the SWITCH CONTROL circuit and fed to the X- and Y- stage. The DOTJOIN circuit is controlled via the BATGE circuit and the SBUS.

All conditions under which the INTENSITY CONTROL has to blank and unblank the CRT beam, are combined in this circuit. Information comes partly via the SBUS and partly via the BATGE circuit. The final intensity signal is fed to the final Z- amplifier stage in the analog oscilloscope section. A switch signal for switching between the analog and the digital intensity signal is generated by the SWITCH CONTROL and fed to the Z-stage.

4 PARTS

4.1 UNITS

Item	Ordering code	Description
A1a	5322 214 90896	A1 Signal unit PM3382
A1b	5322 214 90898	A1 Signal unit PM3384
A1c	5322 214 91027	A1 Signal unit PM3392
A1d	5322 214 90724	A1 Signal unit PM3394 (see also section 5.1.6)
A2a	5322 216 71718	A2 XYZ amplifier unit 100 MHz
A2b	5322 214 90725	A2 XYZ amplifier unit 200 MHz
A3a	5322 214 90899	A3 Microprocessor unit digital
A3b	5332 214 90901	A3 Micro proc. unit digital + IEEE
A4	5322 214 90726	A4 Front PCB
A5	5322 214 90727	A5 CRT controls unit
A6	5322 214 90897	A6 Power supply unit digital.
A8a	5322 214 90984	A8 Digitizer 200 MHz Standard
A8b	5322 214 91029	A8 Digitizer 200 MHz Ext. Mem.
A8c	5322 214 91026	A8 Digitizer 100 MHz Standard
A8d	5322 214 91028	A8 Digitizer 100 MHz Ext. Mem.
A10	5322 214 90895	A10 Connector board
--	5322 218 61479	Extension unit for A3, A6 and A8

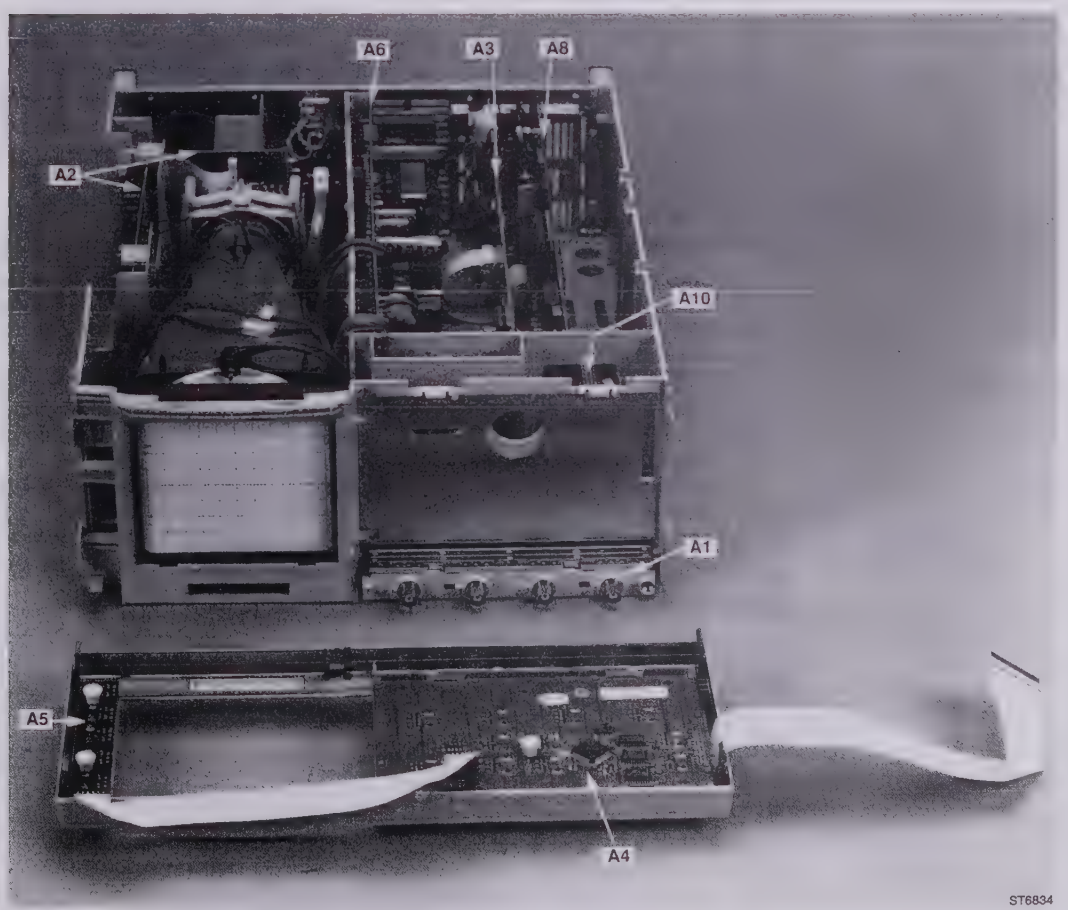


Figure 4.1 Unit Locations

4.2 INTERCONNECTION CABLES

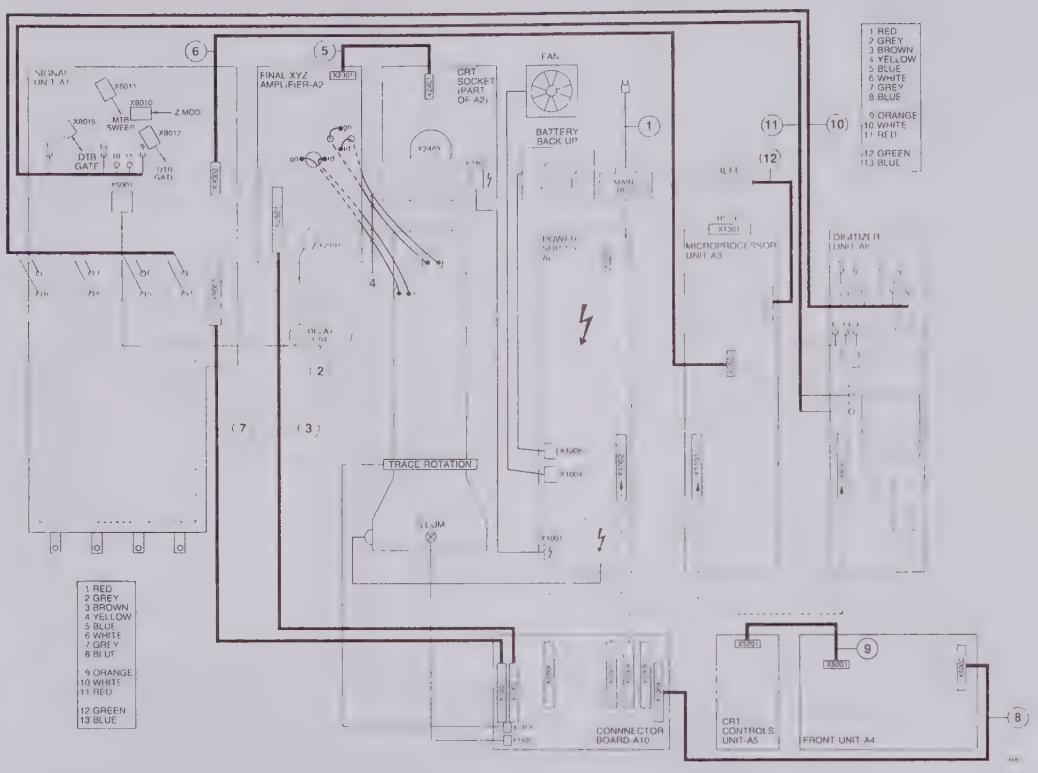


Figure 4.2 Units lay-out and Interconnections

Item	Ordering code	Description
1a	5322 321 21616	Line cord European type
1b	5322 321 10446	Line cord USA type
1c	5322 321 21617	Line cord British type
1d	5322 321 21618	Line cord Swiss type
1e	5322 321 21781	Line cord Australian type
2a	5322 320 40281	Delay line 100 MHz
2b	5322 214 90732	Delay line 200 MHz
3	5322 321 61284	Flat cable 50-pole 18 cm
4	5322 321 61291	Red wire to CRT, 105 mm (4/instr., can be adapted to otherlengths)
5	5322 321 61287	White flat cable 12-pole
6	5322 321 61286	White flat cable 16-pole
7	5322 321 61283	Flat cable 50-pole 10 cm
8	5322 321 61288	White flat cable 28-pole
9	5322 321 61289	White flat cable 12-pole
10	4022 244 08792	50Ω coax 8 x 60 cm
11	4022 244 08801	50Ω coax 2 x 60 cm + 3 x 47 cm
12	4022 244 08811	IEEE cable with connector

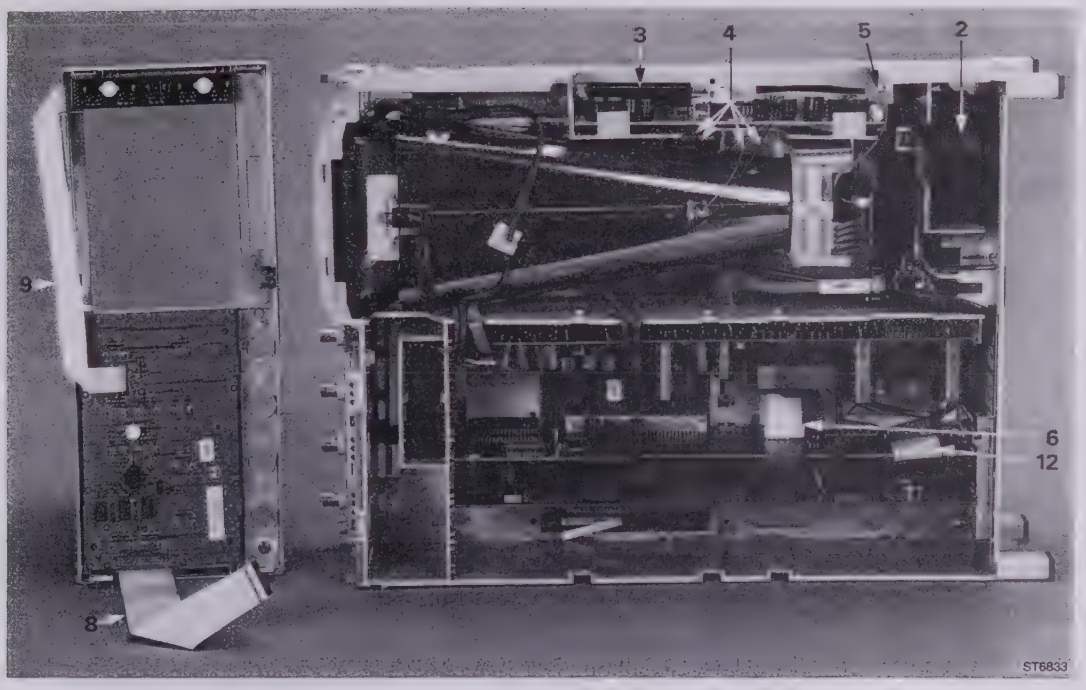


Figure 4.3 Cable locations, top side

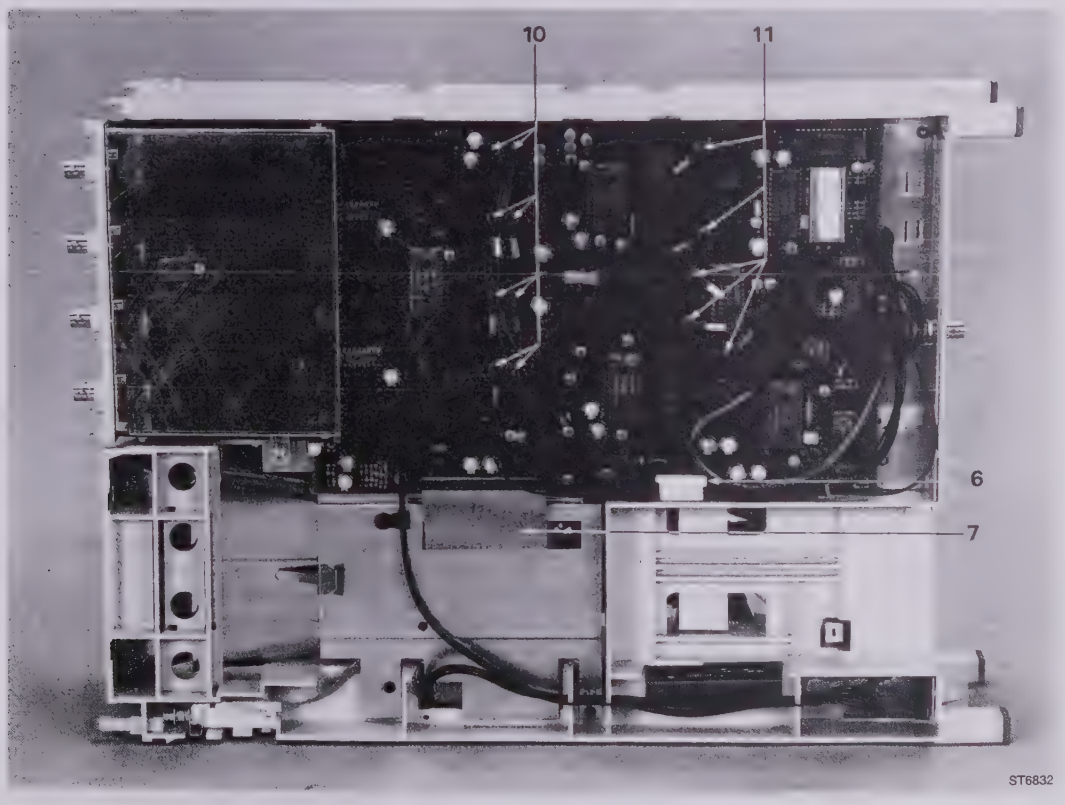


Figure 4.4 Cable locations, bottom side

4.3 MECHANICAL PARTS

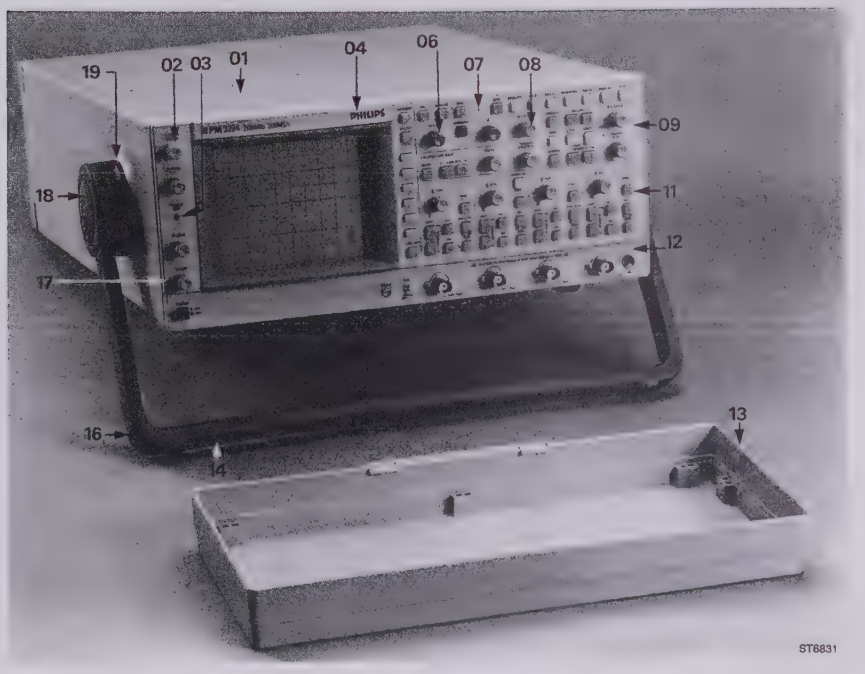


Figure 4.5 Mechanical parts, front and side panel

Item	Ordering code	Qty	Description
01	5322 447 91922	01	Cabinet
02	5322 414 20404	11	Light grey control knob
03	5322 535 93245	01	TRACE ROT shaft
04a	5322 455 81155	01	Textstrip bezel PM3394
04b	5322 455 81154	01	Textstrip bezel PM3392
04c	5322 455 81156	01	Textstrip bezel PM3384
04d	5322 455 81153	01	Textstrip bezel PM3382
06	5322 414 20406	02	Dark grey control knob
07	5322 455 81144	01	CAL-SEAL sticker
08	5322 414 20405	02	Dark mushroom control knob
09a	5322 455 81159	01	Textplate (adhesive) PM3394
09b	5322 455 81158	01	Textplate (adhesive) PM3392
09c	5322 455 81157	01	Textplate (adhesive) PM3384
09d	5322 455 81166	01	Textplate (adhesive) PM3382
11	5322 414 20407	01	Pushbutton mat (buttons not required must be cutoff with a sharp knife)
12a	5322 455 81162	01	Textstrip BNC's PM3392/92
12b	5322 455 81161	01	Textstrip BNC's PM3382/84
13	5322 447 70121	01	Front cover
14	5322 455 81104	01	Textstrip handle
16	5322 498 50326	01	Handle complete
17	5322 455 81141	01	Textstrip CRT controls
18	5322 462 41848	02	Handle cover
19	5322 498 50268	02	Locking clip

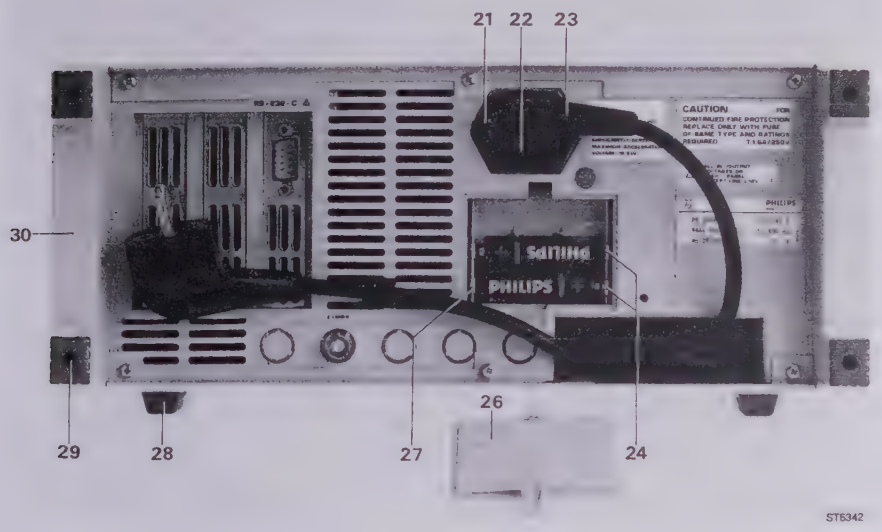


Figure 4.6 Mechanical parts, rear panel

Item	Ordering code	Qty	Description
21	5322 219 82536	01	Mains input connector
22	4822 070 31602	01	Fuse 5x20 1,6AT
23	see interconnections		Line cord
24	5322 492 70941	02	Contact spring single
25	see chapter 2.10.2	02	Batteries
26	5322 456 90426	01	Battery compartment cover
27	5322 492 70975	01	Contact spring dual
28	5322 462 41697	04	Bottom foot
29	5322 462 41846	04	Rear foot
30	5322 256 91793	02	Rear socle

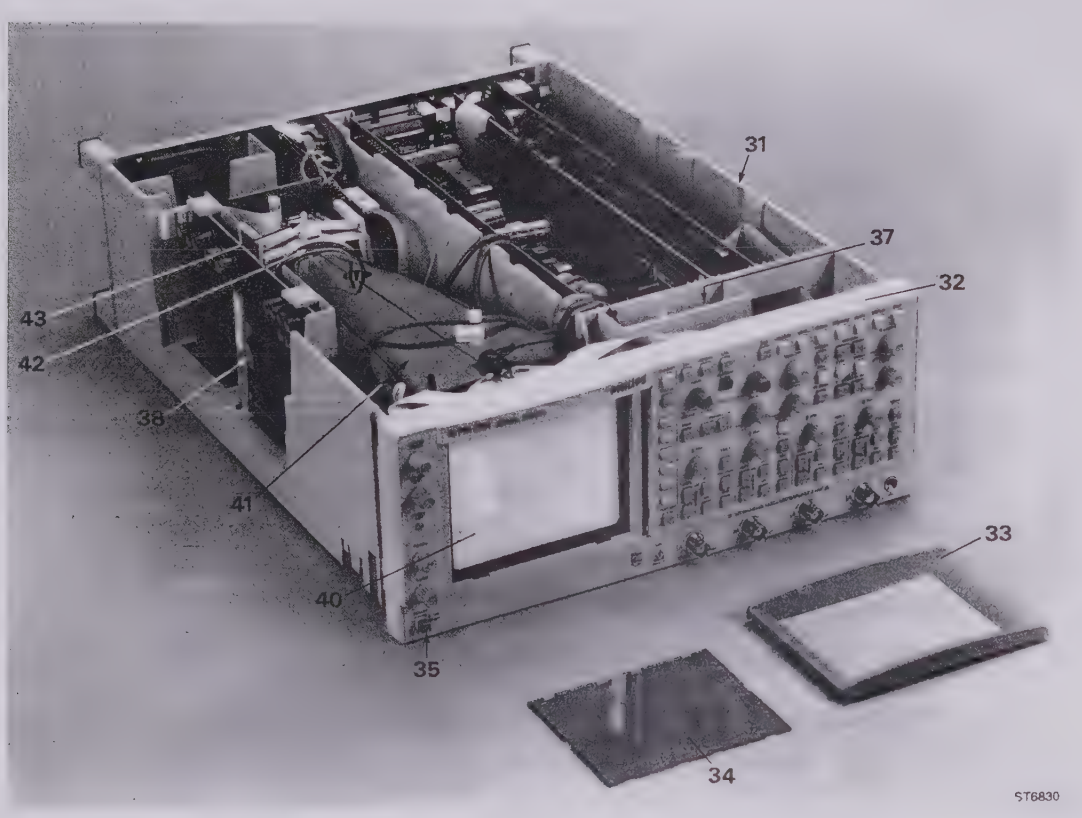


Figure 4.7 Mechanical parts inside instrument

Item	Ordering code	Qty	Description
31	5322 464 90708	01	Chassis complete
32	5322 447 91923	01	Front frame
33	5322 381 11276	01	Bezel
34	5322 480 30181	01	Blue contrast filter
35	5322 414 20403	01	Power on/off knob
37	5322 361 10614	01	Fan
38	5322 255 41227	01	Heatsink
40a	5322 131 20276	01	CRT D14-374GH/123 (V 0001) - 100 MHz
40b	5322 131 20429	01	CRT D14-384GH/123 (V 0001) - 200 MHz
41	5322 466 30493	01	CRT shielding
42	5322 466 30164	01	CRT manchet, rubber
43	5322 462 10263	01	CRT support, plastic

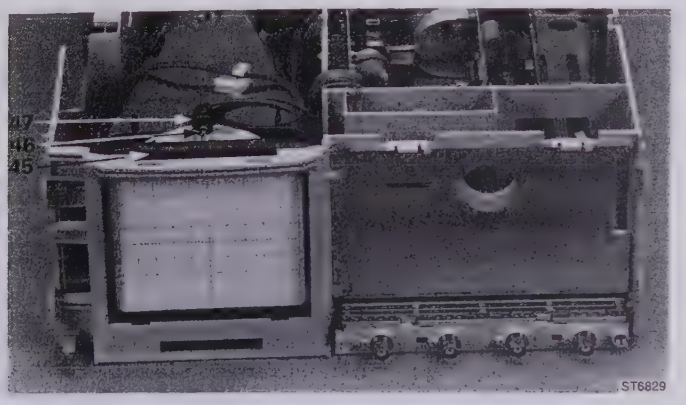


Figure 4.8 Mechanical parts behind front panel

Note: for items not listed refer to chapter 4.1.2 and 4.2.

Item	Ordering code	Qty	Description
45	5322 460 60404	01	CRT frontrubber
46	5322 462 40957	01	Light conductor
47	5322 134 41076	01	Lamp 28V 80mA (E 1001)

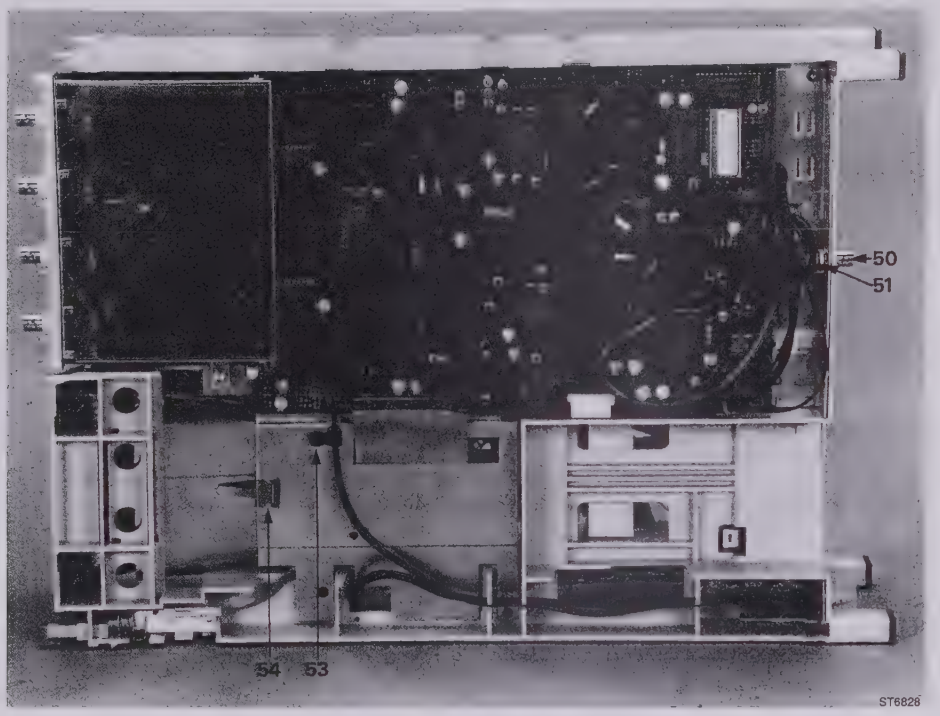


Figure 4.9 Mechanical parts, bottom view

Item	Ordering code	Qty	Description
50	5322 267 10004	01	BNC connector Z-mod
51	5322 290 34022	01	Solder tag for Z-mod
53	5322 401 10954	01	Clamp for delay line (plastic)
54	5322 290 61045	01	Earth contact CRT shielding

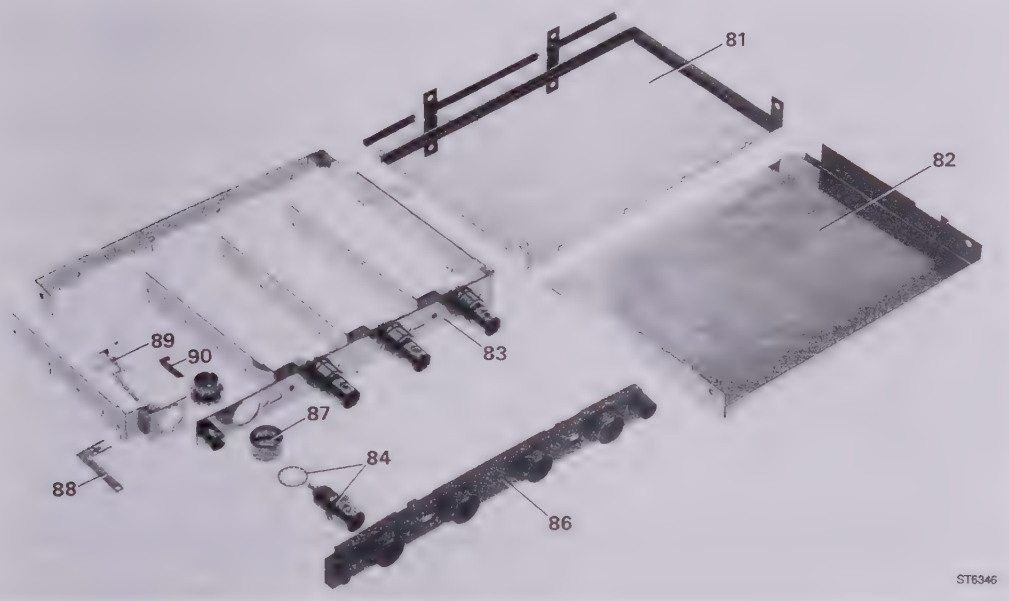


Figure 4.10 Mechanical parts, screening of input circuit

Item	Ordering code	Qty	Description
81	5322 466 30405	01	Top shielding
82	5322 466 30404	01	Bottom shielding
83	5322 256 91792	01	BNC holder
84	5322 267 10191	04	BNC coax connector
86	5322 462 41847	01	BNC insulator, plastic
87	5322 532 21188	04	BNC spacer
88	5322 535 93244	01	Probe calibration pin
89	5322 492 70939	04	Indication spring
90	5322 401 11419	04	Soldering bracket for BNC

5 UNIT DESCRIPTIONS

5.1 SIGNAL UNIT A1

5.1.1 Description A1

5.1.1.1 Introduction

With the exception of the final stages, unit A1 incorporates the vertical channels, the triggering, the time bases and the intensity (Z) control. The unit A1 description is split into the following chapters:
- Input attenuators and calibrator.
- Preamplifiers.
- Y-functions and delay line driver.
- Triggering.
- Main and delayed time base.

The complete signal unit is divided over 18 circuit diagrams. These diagrams and their main interconnections are listed in the table.
Diagram 11 includes the circuitry that controls the functions in the vertical channels.
Diagram 18 shows the connectors that make contact with other units in the oscilloscope via the connector board. These units are:
- The final amplifier unit A2: horizontal deflection signal and intensity control.
- The microprocessor unit A3: control signals and potentiometer functions.
- The power supply unit A6: supply voltages and line trigger signal.

Diagram	Description	Input signal coming from	Output signal going to	Control signal coming from
1,2,3,4	Attenuator ch.1,2,3,4	input 1,2,3,4	diagr.6,7	diagr.5,11
5	Attenuator control	diagr.1,2,3,4	diagr.1,2,3,4,18	diagr.11
6	Preamplifier ch.1,2	diagram 1,2	diagr.8	diagr.11,18
7	Preamplifier ch.3,4	diagram 3,4	diagr.8	diagr.11,18
8	Y-functions	diagram 6,7	diagr.9	diagr.10,11,18
9	Delay line driver	diagram 8	delay line	diagr.10,18
10	Display + trigg control	diagram 18	diagr.8,9	diagr.18
11	Control circuits	diagram 18	diagr. 1,2,3,4,5,6,7,8	diagr.18
12	MTB trigger	diagram 8	diagr.13,15	diagr.12,18
13	TV/line trigger	diagram 12,18	diagr.12,14	diagr.12,14
14	DTB trigger	diagram 8	diagr.15,17	diagr.14,18
15	Time base logic	diagram 12,14	diagr.16,17,18	diagr.15,18
16	Main time base	diagram 15	diagr.17	diagr.18
17	Delayed time base	diagram 15	diagr.18	diagr.18
18	Connectors	unit A6	unit A2,A3	unit A3

5.1.1.2 Input attenuators and calibrator

Diagram 1, 2, 3, 4

The attenuators of channels 1, 2, 3 and 4 are identical, therefore only channel 1 is explained. Every attenuator basically consists of four sections. These sections are:

- The input circuit with 50Ω termination resistor and AC/DC input coupling circuit.
- The high impedance attenuator with divide by 1, divide by 10 and divide by 100 sections.
- The impedance converter. This is the active stage.
- The low impedance attenuator that can give an additional divide by 2.5.

The attenuator sections are switched by voltage pulse operated relays. This reduces power dissipation. Every relay has two change-over contacts. After a pulse the contacts stay in the selected position. One side of each relay coil is connected to the common potential AT12REP; the other side to a voltage that differs per relay.
Setting a relay in the position as drawn in the diagram (rest position) is achieved by a positive 10 ms pulse on common line AT12REP while the other control line stays at 0 V level. The other side of the relay coils that must not switch are applied to the already mentioned 10 ms positive pulse. Switching a relay to the position opposite to the one in the diagram (activated position) is achieved by a 10 ms positive pulse at the other side of the relay while AT12REP is kept at 0 V. This principle is demonstrated in figure 5.1 where the /1 relay is switched to the rest position and the /10 relay is activated.

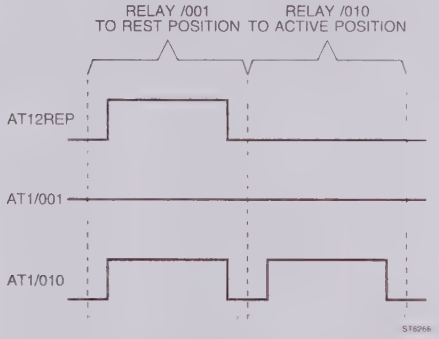


Figure 5.1 Switching pulses for relay

Input circuit

The 50Ω termination resistor is formed by the resistors R1006/R1007. It is switched by relay contact K1001. The NTC resistor R1011 is placed between R1006 and R1007 and measures the temperature of these resistors. This information is routed to the microprocessor on unit A3. If necessary the 50Ω position is switched off.
The DC blocking capacitor is C1001. In DC position the capacitor is not used and discharged via R1002. The signal path is via K1002.

High impedance attenuator

The divide by one section (/1) is switched via the relay contacts K1003. It switches the input signal through without further attenuation.
The divide by ten section (/10) is present between the relay contacts K1004. The /10 is accomplished by R1016, R1027, R1031 and R1032.
The divide by hundred section (/100) is present between the relay contacts K1006 and K1004/6,4. The /100 is accomplished by R1021 and R1023.
LF square wave calibration is achieved via the dual varicap diode V1002. Influence of the signal on the capacitance value is eliminated by two diodes with opposite polarization. The compensation factor and consequently the voltages AT1LFCOR1 and AT1LFCOR0 are depending on the selected attenuator position.

The signal ATCAL is applied to /33 attenuator R1008/R1009. ATCAL can supply several accurate voltages that are used for vertical calibrations.

Impedance converter
This active stage consists of three sections with different frequency ranges. The sections partly make use of the same components:
- The HF section for frequencies above 5 kHz. It is formed by C1021, FET V1006 and the two emitter followers V1008 and V1009. The FETs V1004 and V1005 are used for input protection. V1007 is a current source.
- The LF section for frequencies 30 Hz to 5 kHz. It is formed by operational amplifier N1001 (gain 2x) that receives the LF input signal via divide-by-two attenuator R1031/R1032. The capacitors C1023 and C1025 are frequency determining components in the N1001 feedback loop. The N1001 output signal is routed via R1034, V1006 and the emitter followers V1008 and V1009.
- The DC section for frequencies DC to 30 Hz. It is formed by operational amplifier N1001 (gain 2x) that receives the input signal via divide-by-two attenuator R1031/R1032. Via feedback resistor R1037 the voltage at the output of the impedance converter is compared with the input level via the + and inputs of N1001. This keeps the DC output value of the impedance converter exactly at the required value. This compensates for DC drift. Part of the feedback loop is V1001 that determines the low-frequency gain. The N1001 output signal is routed via R1034, V1006 and the emitter followers V1008 and V1009.

The low impedance attenuator is formed by R1072 and R1073. Switching is accomplished by V1012 and V1013. V1012 conducts in the /1 position and V1013 in the /2,5 position. The attenuator output signal is an unbalanced signal. The unbalanced output signal is applied to the succeeding stage via R1071 and via R1074.

Diagram 5

Probe indication circuit
There are four identical circuits of which the one for channel 1 is described. The resistor in the indication ring of the probe is present between X1002 and ground potential. The resistance value is measured by the microprocessor on unit A3.
The temperature of the 50Ω termination resistors on diagram 1 is measured by NTC resistor R1011. This resistor is placed in between the two termination resistors. If the temperature gets too high, the + input of N1101 becomes lower than the input. This makes output 13 of N1101 low and 0 volt is detected by the microprocessor via the probe indication line PROBE1. This is the sign for the microprocessor that the 50Ω resistor is too hot and it is switched off.

LF square wave calibration
This circuit produces the voltages for the varicap diodes V1002. The diodes require control voltages with opposite polarity. There are four identical circuits for the four vertical channels. The input signal AT1LFCAL is produced by a DAC and has the range 0 ... 10 volt. This is converted via the operational amplifiers N1102, N1103 into two signals that range from -5 ... -15 volt (AT1LFCOR0) and +5 ... +15 volt (AT1LFCOR1) respectively.

Amplitude Calibrator
This circuit consists of 8-position multiplexer D1152 and operational amplifier N1104. It can supply 8 accurate voltages of 10V, 5V, 2V, 1V, 500mV, 200mV and 0V. They are supplied to the vertical channels 1, 2, 3 and 4 for calibration voltages. The voltages are derived from a voltage divider with precision resistors R1192 through R1197. The divider is supplied with an accurate 10 V reference voltage. Under control of a three bit address ATCAL0 ... ATCAL2 one of the outputs of the voltage divider is selected via D1152. This signal is routed to the vertical channels via buffer N1104.

Loop gain calibration
The output voltage range of a digital-to-analog converter (DAC) is changed via resistor network R1112, R1113 and R1114. The output voltage is applied to V1001 that determines the low-frequency gain in the channel 1 attenuator.

Calibrator

This circuit is used for probe adjustment. It is built up around triple analog multiplexer D1151. The sections D1151/1,2,10,15 and D1151/3,4,5,9 form a 2 kHz oscillator. The third section D1151/11,12,13,14 switches in the 2 kHz rate of the oscillator. The oscillation principle is now explained with the simplified diagram in the figure.

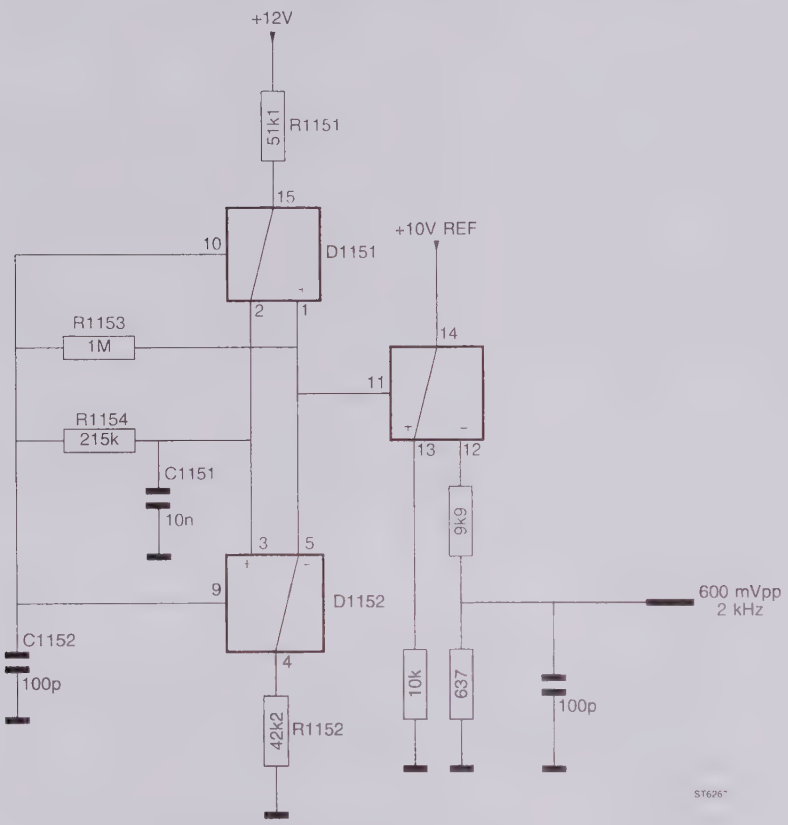


Figure 5.2 Simplified diagram of CAL generator

The start is in the situation as given in the figure. C1151 charges from +12V via R1151 and the switch contacts 15 and 2. After some time the voltage across C1151 reaches the digital "High" level and the switch contacts go to the opposite position. This causes C1151 to discharge to 0V via switch contacts 3 and 4 and R1152. Via switch contacts 15 and 1 and R1153 a gap is created between the switching moments. The charging/discharging process makes pin 11 high and low at a 2 kHz rate. This connects voltage divider R1156/R1157 and R1158, R1159 with + 10VREF or leaves it floating in the 2 kHz rate.

5.1.1.3 Preamplifiers

Diagram 6, 7

The preamplifiers for channel 1 and 2 and associated current sources are given in diagram 6. Diagram 7 gives this for channel 3 and 4. Channel 1, 2, 3 and 4 are identical, therefore only channel 1 is explained.

The output signals AT1OUT1 and AT1OUT0 from the channel 1 attenuator are applied to pin 3 and 5 of amplifier IC D1201. The balanced output signal of this IC is available at pin 18 and 19. This signal is routed to the Y-functions section via the level shifters V1201 and V1202.

The amplifier D1201 can be switched to a number of attenuation/gain positions that are dependent on the channel 1 AMPL position. The gain x1 position is determined by R1205/R1206/C1205 that are present across pin 6 and 7. The x1 is switched by control signal PA1X1.
The attenuation /2 is determined by R1207 and switched by PA1/2.
The gain x5 is determined by R1208/R1210/R1215/C1210 and switched by PA1X5. Continuous gain control is determined by DAC output signal VAR1 that is applied to pin 20. This signal comes from microprocessor unit A3. It is used for front panel gain control in fine steps and also for gain calibration.

The complete range of the channel 1 input sensitivities is controlled via front panel control AMPL. It is accomplished by the combination of input attenuator positions and the x1, /2, x5 and the VAR1 functions.

Offset control is achieved via the DAC output signal PA1OFFSET that is applied to the D1201 input pin 13. The DAC signal PA1OFFSTRG gives an offset signal in the current sources V1208 (PA1LSA) and V1209 (PA1LSB). PA1LSA and PA1LSB are applied to level shifters V1201/V1202. This is used to compensate for offset in the trigger path and also influences the offset in the vertical channel. This in turn is compensated via the POS1 signal in the Y-functions section.

The circuit in the bottom half of the diagram includes a number of current sources for the channel 1 and 2 preamplifiers. The reference for all these current sources is PAVREF that is present at N1251/pin 3. This is converted in a reference voltage at the collector of V1252 that is applied to the current sources. The currents for channel 1 are PA1ICL, PA1ISY, PA1LSA and PA1LSB. The currents for channel 2 are PA2ICL, PA2ISY, PA2LSA and PA2LSB. PA2LSA and PA2LSB are adjustable via DAC output signal PA2OFFSTRG.

5.1.1.4 Y functions and delay line driver

Diagram 8

This diagram shows the channel 1, 2, 3 and 4 function circuits D1301, D2301, D3301 and D4301. The balanced output signals of each cicuit are available at pin 7 and 8. They are all applied to the resistance network R1313 through R4314 that is shown on the next diagram. The output of this network feeds the delay line driver.

The four function circuits are almost identical. Compared with channel 1 and 3, channels 2 and 4 have additional invert functions. For this reason, only the channel 2 circuit is explained. Here the balanced input signal is applied to pin 25 and 26 of D2301. The balanced output signal at pin 7 and 8 is switched by control signal CNT2CH-HX. The balanced output signals FNC2MTR0 and FNC2MTR1 that are available at pin 13 and 14 are used for triggering the main time base. This is switched via control signal CNT2MT-HT. The balanced output signals FNC2DTR0 and FNC2DTR1 that are available at pin 1 and 2 are used for triggering the delayed time base. This is switched via control signal CNT2DT-HT.

Channel 2 position control is achieved via an adjustable analog DAC voltage POS2 from the microprocessor unit A3. This voltage is applied to input 9 of operational amplifier N2202. This IC converts the DAC voltage POS2 (1 ... 4 V) into a voltage between -8 and +8 V. This voltage is converted into a current via resistor R2311, because pin 12 of D2301 is a virtual ground.

The balanced output signals FNCYOP0 and FNCYOP1 at pin 5 and 6 of D2301 of the channel 1 can be used to provide signals for the Y-out option. The (optional) Y-out circuit (present in channel 1 only) is located on an additional unit that is connected via the connectors X1303 through X1310. This is switched via control signal YOP-HX at pin 4. If no option installed, the signal is switched off by a low level supplied via R1312. If the option is present the switching is achieved by a signal coming from the additional unit.

The balanced output signals FNC1DPO0 and FNC1DPO1 at pin 9 and 10 can be used to provide signals for digital signal storage. The signals are routed via the coaxial sockets X1301 and X1302 to the sockets X8001 and X8002 on digitizer unit A8. This is present on all 4 channels. Biasing current for these outputs is provided via V1302, V1313 and R1307. The capacitor C1301 determines the cut-off frequency if the bandwidth limiter is active. The limiter is switched via signal FNCBWL.

The following table summarizes the functions and related pin numbers of the IC's used in the circuit diagram:

Output (pin)	On/Off (pin)	Invert (pin)	Bandw. Lim. (pin)	Pos (pin)
MTB Trig (13,14)	20	19	--	--
DTB Trig (1,2)	24	23	--	--
Y-out (5,6)	4	3	28	--
Digital out (9,10)	--	3	28	12
Chann. out (7,8)	11	3	28	12

Diagram 9

This diagram shows the delay line driver and associated circuitry. The delay line driver itself consists of the balanced amplifier branches V5003/V5006/V5008 and V5004/V5007/V5009. These amplifiers serve as a 9x amplifier and level shifter. V5011/V5012/V5013/V5014 clamp the input signal in order to reduce the output voltage swing applied to the delay line. The balanced input current (100 uA/div) signals from channel 1, 2, 3 and 4 are FNC1OUT0/FNC2OUT0/FNC3OUT0/FNC4OUT0 and FNC1OUT1/FNC2OUT1/FNC3OUT1/FNC4OUT1. The output voltage (45 mV/div when connected to the delay line, 90 mV/div when open) signals DLDOUT0 and DLDOUT1 supply the delay line. The resistors R5051 and R5052 give correct 50Ω termination impedance.

The Y-offset control part is supplied with the DAC output signal DLDOFFSET (delay line driver offset) that is used for instrument calibration. The DAC output signal TRASEP gives trace separation between main and delayed time base display in alternate time base mode. TRASEP is passed through via analog switch D5001/6,8,9 if control signal TRASEP-HC is high.

Operational amplifier N5001/5,6,7 makes a stable +4 V reference voltage.
Operational amplifier N5001/2,3,1 keeps DLDDCLEVEL0 and DLDDCLEVEL1 at equal level by influencing the level at DLDDCCORR.

Diagram 10

This diagram comprises the circuitry that controls the vertical channels 1, 2, 3 and 4 and the main (MTR) and delayed (DTR) trigger sources. The heart is formed by IC D9009. The IC is loaded with information about the control functions that must be executed. This happens via the input lines SCL (Serial CLock) and SDA (Serial DAta) that come from the microprocessor unit A3. At turn-on D9009 gets a reset at pin 17. This occurs via V5506 which is controlled by output D9004/11 on the next diagram.

The channels 1, 2, 3 and 4 are switched via the output pins 2, 3, 4 and 5 of D9009. The main time base trigger (MTR) source of channel 1, 2, 3 and 4 is switched via the control signals that are available at pin 2, 12, 1 and 13 of multiplexer D5501. This multiplexer is supplied with 3 lines that come from pin 25, 26 and 27 of D9009. The signal CNT2MTI-HT that is present at pin 11 of AND gate

D5503 gives the necessary inversion of the main trigger path if channel 2 is in the inverted mode. The signal CNT4MTI-HT that is present at pin 4 of AND gate D5503 gives inversion of the main trigger path if channel 4 is in the inverted mode.

The delayed time base trigger (DTR) source of channel 1, 2, 3 and 4 is switched via the control signals that are available at pin 2, 12, 1 and 13 of multiplexer D5502. This multiplexer is supplied with 3 lines that come from pin 22, 23 and 24 of D9009. The signal CNT2DTI-HT that is present at pin 10 of AND gate D5503 gives the necessary inversion of the delayed trigger path if channel 2 is in the inverted mode. The signal CNT4DTI-HT that is present at pin 3 of and-gate D5503 gives inversion of the main trigger path if channel 4 is in the inverted mode.

The input pin 9 ALTCLN of D9009 gives channel/trigger source switching in the alternate display mode. The circuit with V5503 converts the current input signal ALTCLK (ALTernate CLock) from the time base logic into a voltage signal. The input pin 17 PUDML gives D9009 a preset when switching the oscilloscope on.

For the chopped display mode a chopper oscillator V5501/V5502 is present. It is switched on when control signal CHSW (CHopper SWitch) is high. The output signal of the oscillator is applied to pin 7 of D9009. The signal CHBLANK gives display blanking when switching between one channel to another.

The D9009 output signal TRASEP-HC activates the trace separation control in alternate time base mode. This signal is high if the delayed time base is active and low for the main time base. The output signal TBSEL controls the choice between main time base (high) and delayed time base (low) for horizontal deflection.

Diagram 11

This diagram includes the generation of control signals for the channel 1, 2, 3 and 4 attenuators, preamplifiers, Y-function and delay line driver circuits. The names of the control signals indicate exactly which circuit part is controlled:

- The signals starting with AT1, AT2, AT3 and AT4 control the ATtenuators of respectively channels 1, 2, 3 and 4. The attenuators and associated signal name lists are indicated in the description belonging to figures 1, 2, 3 and 4.
- The signals starting with PA1, PA2, PA3 and PA4 control the PreAmplifiers of respectively channels 1, 2, 3 and 4. The preamplifiers and associated signal name lists are indicated in the description belonging to figures 6 and 7.
- The signals starting with FNC1, FNC2, FNC3 and FNC4 control the Y- FuNCtion (channel and trigger source switching) of respectively channels 1, 2, 3 and 4. The Y-function blocks and associated signal name lists are indicated in the description for diagram 8.
- The signals starting with DLD control the Delay Line Driver. This circuit part and associated signal name list are indicated in the description for diagram 9.

A part of the control functions are simple on/off functions; e.g. the switching of a certain attenuator section. Other control functions consist of an adjustable DC voltage; e.g. the DC voltage that determines the gain of an amplifier section.

D9001 and D9002 have outputs that are able to drive the relays in the attenuator sections of channels 1, 2, 3 and 4. The IC's are controlled by the microprocessor on unit A3. This happens via the data signal SDA (Serial DAta) and the synchronization signal SCL (Serial CLock). The enable signals

DLEN0-HT (Data Latch ENable) and DLEN1-HT determine if D9001 or D9002 reacts on the SDA/SCL signals. The figure below indicates the relation between SDA and SCL.

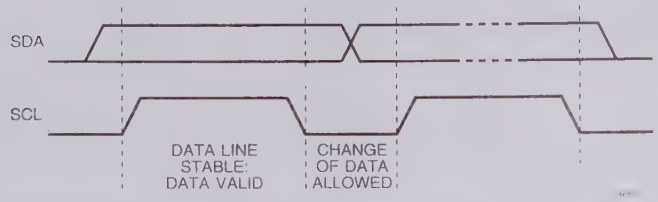


Figure 5.3 Relation of serial bus signals SDA and SCL

D9003 and D9004 have outputs that control a number of on/off functions in the preamplifier. The IC's are connected in cascade as a shift register. The IC's are controlled by the microprocessor on unit A3. This happens via the data signal SDA (Serial DAta) and the synchronization signal SCL (Serial CLock). The enable signal STROBE0-HT in relation with SCL and SDA is indicated in the figure below. New data can be clocked into the shift register if STROBE0-HT is low. The new data becomes available at the outputs at the low-to-high transition of STROBE0-HT.

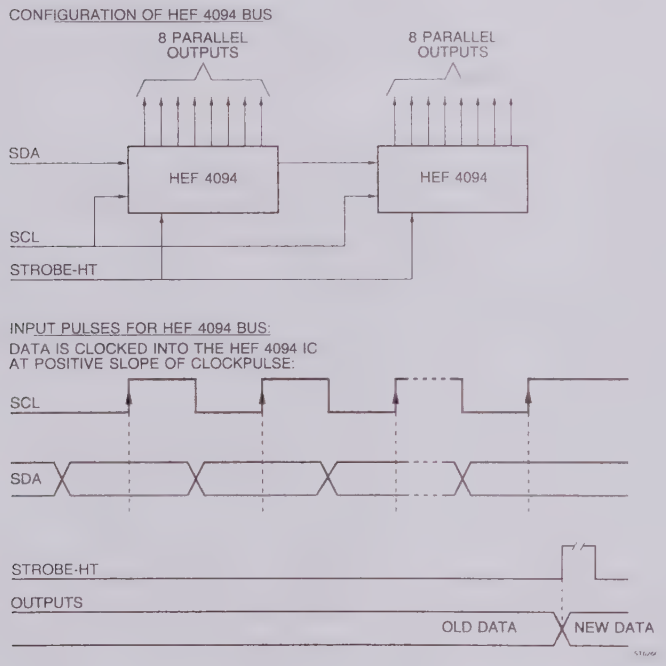


Figure 5.4 Configuration of serial control bus

N9001, N9002 and N9003 are octal digital-to-analog converters (DAC's). Each IC has 8 outputs capable of delivering a DC voltage that is adjustable between 0.5 and 9.5 V. This is controlled by the microprocessor on unit A3 via 6 bits of information that allow 64 adjustment steps. This happens via the data signal SDA (Serial DAta) and the synchronization signal SCL (Serial CLock). The data bits are preceeded by address bits that are compared with the fixed address A0/A1/A2 applied to pin 7, 8 and 9. This determines if N9001, N9002 or N9003 reacts on the bitstream.

Note: a solder pad is present in the SDA and SCL input lines of every IC. This gives the possibility to isolate a suspected IC from the other in case a fault is suspected.

5.1.1.5 Main and delayed time base triggering

Diagram 12

The main time base triggering (MTR) is mainly formed by IC D6541. The other IC D6621 is the peak-peak detector for the trigger level. The balanced input signal for triggering on vertical channels 1, 2, 3 or 4 is applied to pin 7 and 8. This signal can originate from one of the 4 vertical preamplifier sections where the source selection is also done. The dc biasing currents come from the circuit with V6506, V6507 and V6532. This circuit is also supplied with the line trigger sinewave signal MTRLINE that comes from the power supply. This signal can be used for mains/line triggering and is selected on the next diagram.
The output signal of D6541 is available at pin 19 and 20. This signal is routed to the main time base (MTB) via the level shifters V6573 and V6574. The signal MTRVIDEO from output pin 2 of D6541 is routed to the TV trigger circuit.

The IC D6541 incorporates the filters for HF reject (external capacitor C6549), LF reject (external capacitor C6551) and AC (external capacitors C6559, C6561, C6562). These filter modes are switched with the control signals MTRLF-HD (pin 3) and MTRHF-HD (pin 14). Positive/negative slope and video are switched with the control signals MTRSLOPE (pin 21) and MTRTVSEL-HD (pin 4). The logic levels of these control signals are indicated in two tables on the diagram. The signal MTRSEN is a DAC output voltage that determines the gain of the trigger amplifier.

A balanced current signal leaves D6541 at pins 26 and 27. This signal is converted into a voltage signal via V6604 and V6606. The voltage signal is applied to pins 3 and 7 of the peak-peak detector D6621. This IC detects the positive and negative peak values of the trigger signal. It reduces in the peak-peak trigger mode (switched with MTRPPLEV-HD) the range of the level (LEVMTB) to just within the peak-peak signal value.

The output of the peak-peak detector is present at pin 14 and 15 and routed to level input pin 22 and 23 of D6541, via the level shifter with V6667, V6668, V6686 and V6687. At this point a level offset correction is also introduced via DAC signal MTRBAL. The level is fixed in TV trigger mode by giving signal LEVMTB a predefined fixed level. The output pulse MTRTVSYNC from the TV synchronization separator circuit (see next diagram) is applied to the base of V6687. This signal is interrupted if the TV trigger mode is off.

The series parallel converter D9011 has outputs that control a number of on/off functions in the MTB triggering. D9011 is controlled by the microprocessor on unit A3. This happens via the data signal SDA (Serial DAta) and the synchronization signal SCL (Serial CLock). The enable signal is STROBE1-HT.

Diagram 13

This diagram shows the TV trigger circuit. The signal MTRVIDEO from pin 2 of MTR circuit D6541 is applied to the input of the TV CLAMP circuit V6754/V6757/V6759/V6763/V6768. The peak level of the synchronization pulses is detected via V6757 and C6758. The TV signal at the base of V6768 is kept at a constant level via V6759 and V6754. Diode V6761 cuts off the video information so that only synchronization pulses are applied to input pin 2 of N6771.

The TV synchronization separator N6771 is able to decode three different types of sync pulses. The analog control signal MTRTVMODE at pin 6 can have 3 different values that determine the TV standard in which the circuit will work. The standards and respective control voltages are indicated in a table.

N6771 separates the TV synchronization pulses. The following signals are available at its outputs:
- Pin 1 carries negative going line (MTRTVL) pulses. These pulses can be applied to the MTB trigger (MTR) section via multiplexer D6781. Via multiplexer D7711/3,4,5,9 they are applied to the delayed trigger (DTR) section.
- Pin 3 carries the negative going field pulses (MTRTVFR) that appear at the beginning of field 1 and field 2.
- Pin 7. The signal is high during field 1 and low during field 2. Field 1 and Field 2 together form one frame.

The set/reset flipflops D6779 make the field 1 (MTRTVFLD1) and field 2 (MTRTVFLD2) pulses. As input signals are used the output signals at pin 7 and 3 of N6771.

The multiplexers D6781 and D7771 select the TV and line trigger sources for MTR and DTR:
- The MTB TV trigger signal is MTRTVSYNC. It originates from D6781/14.
- The DTB TV trigger signal is DTRTVL. It originates from D7711/15.
- The signal VSYNC from D6781/4 is not used: it will be used for extensions such as digital signal storage.
- The MTB mains/line trigger signal is MTRLINE. It is switched via D5001/10,11,12.
- The DTB mains/line trigger signal is DTRLINE. It originates from D7711/13.
- Signal VSYNC carries the selected TV field 1 or TV field 2 pulse. This signal is used on the digitizer unit A8. It is routed via socket X6794 on unit A1 to X8505 on unit A8.

Diagram 14

This diagram shows the DTB trigger (DTR) circuits. This circuit is build up around D7541. It is a simplified replica of the main trigger circuit. This because of the fact that the DTR is not equipped with peak-peak trigger facility. The level signal LEVDTB is applied almost directly to pin 22 and 23 of D7541. The transistors V7686 and V7687 are used to convert an asymmetrical LEVDTB signal into a symmetrical signal. At this point the TV line synchronization pulses (DTRTVL) are applied to the delayed trigger section when required.

The XDEFL CIRCUIT is used for X-DEFLection via the balanced X deflection signals DTRXDEF1 and DTRXDEF0 (pin 15 and 16 of D7541). The outputs of the circuit are TBXOUT1/TBXOUT0 and are applied to the time base section. It is there where the selection is done between X- deflection signal, MTB sawtooth and DTB sawtooth. Position control is achieved by signal DTRXPOS which is derived from LEVDTB via switch D7711/4,9,3. This switch is indicated on the preceding circuit diagram.

D9013 is used to determine the modification state of the unit A1. This is important in connection with the microprocessor hardware. The 8 outputs of D9013 are made high one by one after the oscilloscope is turned on. Via output diodes V7801 ... V7808 the high level is passed through. Depending on the modification state of the unit, one or more diodes are inserted into the p.c.b.. This gives the possibility to program 256 different modification levels.

5.1.1.6 Main and delayed time base and control logic

Diagram 15

This diagram incorporates the control logic for the main and delayed time base. This logic consists mainly of IC D8004. Also the input signal for the final Z-amplifier is generated on this diagram and occurs in D8003.

The selected trigger signals for the main time base are MTRIG0/MTRIG1 and are applied to pin 7 and pin 6 of D8004. This results via output pin 24 and V8013/V8014 into signal MTBGATE that starts the main time base (MTB). Signal STRCALM-HT is used to start the MTB via V8003. This occurs during autocalibration of the MTB.

The signal ALTCLK is derived here via V8018. This signal is used for display switching in ALTernate display mode. This happens in D9009 in the section that controls the display and trigger sources.

The selected trigger signals for delayed time base (DTB) are DTRIG0/DTRIG1 and are applied to pin 9 and pin 8 of D8004. This results via output pin 18 and V8012/V8011 into signal DTBGATE that starts the DTB. Signal STRCALD-HT is used to start the DTB via V8007. This occurs during autocalibration of the DTB.

D8004 has inputs and outputs with the following functions:
- TBEOHO-LX goes low at the end of the hold-off period.
- TBAUTO-LD is low if auto free run mode is active.
- TBEOM-HX goes high at the end of the MTB sweep.
- TBSTD-LX goes low to start the DTB sweep.
- TBEOD-HX goes high at the end of the delayed sweep.

- TBNOTTR-HT goes high if the MTB is not triggered.
- TBSEL selects MTB if high and DTB if low.
- TBSSG-HT goes high at the end of a single sweep.
- DSOM (pin 2) goes high if a MTB trigger occurs. The connected circuit with V8023/8024 generates signal DSOMOUT that is routed via coax socket X8011 to socket X8503 on digitizer unit A8.
- DSOD (pin 14) goes high if a DTB trigger occurs. The connected circuit with V8029/V8031 generates signal DSODOUT that is routed via coax socket X8014 to socket X8501 on digitizer unit A8.
- DSODGATE from V8012/V8011 informs the digitizer on unit A8 that the analog delayed sweep is on. The signal is routed from coax socket X8013 to socket X8502.
- TVHOLD-LD is generated on the digitizer and can extend the hold off time of the main time base. This is used in TV trigger mode. The signal is routed from X8504 on unit A8 to X6010 on unit A1.
- TBHOTXT informs the digitizer A8 about the presence of the hold off period of the analog time base. The signal is routed to X8101/A12 on unit A8 via the connector board A10.

V8061/V8062/V8063/V8066 form the "V peak-peak circuit". It plays a role as the automatic positioning of the cursors on the top and bottom of the signal (Vpp mode). This function works via the DTB trigger circuit and is mainly software based. V8062/V8063 form a set-reset flipflop with inputs with hysteresis. The flipflop is set with the DSOD pulse that goes high at the moment that a DTB trigger pulse is detected. This is signalled to the microprocessor via V8066 which makes the TTL signal VPPTEST-LD. The shape of the waveform is scanned by the microprocessor by monitoring the signal VPPTEST-LD at different DTB trigger LEVEL positions. The flipflop is reset by the microprocessor via signal STRCALD-HT.

The balanced output signals ZTRA0 and ZTRA1 from pin 10 and 11 of D8003 are applied to the final Z-amplifier in order to control the intensity on the CRT screen. An important input signal is TBZB from D8004/19. This signal is high if the MTB sweep is on and during this time the light on the CRT is on. The intensified part during the time that the DTB sweep is on is switched on if signal TBZA is high. TBZA originates from D8004/20.
The signal CHBL that is applied to D8003/15 is influenced from the chopper blanking signal CHBLANK-HX and from the external Z-MODulation signal. The DAC output signals TBINTRAT-XA (pin 3) and INTTRA respectively influence the intensity ratio between MTB and DTB display and the total intensity on the CRT.
The signal TBXDEFL-LD (pin 6) switches the light continuously on if it is low. This happens in the X-DEFLection mode.

The circuit with V8002/V8006 is used for Z-MODulation via the BNC socket at the rear of the oscilloscope. The output signal of the circuit is TBZEXT and it is applied to D8003/16.

D9008 has outputs that control a number of on/off functions. The IC's of this type are connected in cascade as a shift register. The IC's are controlled by the microprocessor on unit A3. This happens via the data signal TBD01 (from the preceding D9011); the synchronization signal TBSCL (Time Base Serial CLock). The enable signal is STROBE1-HT. New data can be clocked into the shift register if STROBE1-HT is low. The new data becomes available at the outputs at the low-to-high transition of STROBE1-HT.

N8005 is an octal digital-to-analog converter. The IC has 8 outputs that can deliver a DC voltage that is adjustable between 0.5 and 9.5 V. This is controlled by the microprocessor on unit A3 via 6 bits of information that allow 64 adjustment steps. This happens via the data signal SDA (Serial DAta) and the synchronization signal SCL (Serial CLock). The data bits are preceeded by address bits that are compared with the fixed address A0/A1/A2 applied to pin 7, 8 and 9. This determines if N8005 or similar IC's in the instrument will react on the bitstream.

Note: a solder pad is present in the SDA and SCL input lines of each IC. This gives the possibility to isolate one IC from the others in case a fault is suspected.

Diagram 16

This diagram indicates the timing circuits for the MTB. The principle of the time base is that a capacitor is charged with a constant current. This gives a time-linear voltage across the capacitor; the so- called sawtooth or sweep signal. The timing capacitance consists of C6011 that is always in circuit and C6012, C6013 that are activated via the switching transistors V6016 and V6019. The MTB control is done in IC D6011.

The constant current is supplied via transistor V6003 and V6005. The current source consists of voltage divider R6002 through R6007 with precision resistors. The voltage across this divider can be influenced by DAC output voltage MTBVAR via N6007/5,6,7 and V6001. This is necessary for continuous time/div control (VAR) and calibration. The voltage on a tap of the voltage divider can be selected via multiplexer D6001. This voltage (MCSCONTROL) is applied to the base of V6003 and V6004. This occurs via operational amplifier N6006. Via multiplexer D6002 two different emitter resistance values can be selected for V6003 and another two for V6004. The resistance values differ by a factor of 10: the emitter resistance for V6003 is switchable between R6014 (time base magnifier x10) and R6013 (magnifier x1). The emitter resistance for V6004 is switchable between R6016 (time base magnifier x10) and R6015 (magnifier x1).

The current from V6004 is applied to pin 16 of D6011 and is used as a reference. The sawtooth that is generated across the timing capacitor(s) is applied to pin 18 of D6011. Inside this IC is the time base switching transistor. The start of the sawtooth is initiated by signal MTBGATE that is applied to pin 20 of D6011. The sawtooth is also applied to pin 17 and converted into a balanced output signal that is available pin 12 and 13. The MTB sweep pickoff circuit consists of Source follower V6013 (and matching V6014) and emitter follower V6012. Horizontal position control is achieved via DAC output signal TBXPOS at pin 14.

Input signal TBCALREF at D6011/28 and output signal MTBCALTST at D6011/24 provide autocalibration of the time base. The sweep is switched on via STRCALM-HT and MTBGATE and compared with reference voltage TBCALREF. Via switching of output signal MTBCALTST, the microprocessor knows if the current source delivers the correct current. In case of inaccuracies the microprocessor makes corrections.

The start of the DTB is initiated by a low level of signal TBSTD-LX at pin 1 of D6011. The signal is generated via comparison of the MTB sawtooth signal and the adjustable DC voltage DTBM (delay time multiplier). The DTBM signal is coming from DAC output N6014/6 via operational amplifier N6008/5,6,7.

The signal TBEOM-HX at pin 4 of D6011 becomes high at the end of the MTB sweep. The signal TBEOHO-LX at pin 5 of D6011 becomes low at the end of the hold off period. The length of the hold off period is determined by the DAC output voltage HOLDOFF that is applied to D6011/7.

The MTB is switched on by making MTBONOFF (D6011/11) high. This signal is derived from control signal TBSEL. TBSEL is high during X deflection by the MTB and low during DTB. The MTB is also off in external X- deflection mode.

V6006 is on during the fast time base positions. It activates a stabilizing circuit that is connected with D6011/21.

The circuit with V6042 and C6033 assures that the hold off time in the fastest time base positions will never become shorter than 3 us. The circuit with C6035, V6002, C6017, V6008 and C6415 is responsable for the hold off timing. C6035 is always in circuit and C6017 and C6415 are activated by switching transistors. The capacitors are charged in parallel with the MTB timing capacitors. During the hold-off time that follows they are discharged by a current source inside D6011. The hold- off time can be varied by varying the discharging current.

The table shows the active main time base sections as a function of time/div setting:

main time base									
Time	Current source				Charge	Timing caps		Hold off caps	
/div	MTBI2	.I1	.I0	.I10	Current V6005/c	C6012 MTBC2	C6013 MTBC3	C6415 HONAN	C6017 HOMU
0.5s	L	L	L	L	8uA	L	H	H	H
0.2s	L	L	H	L	18uA	L	H	H	H
0.1s	L	H	L	L	35uA	L	H	H	H
50ms	L	L	L	H	70uA	L	H	H	H
20ms	L	L	H	H	175uA	L	H	H	H
10ms	L	H	L	H	350uA	L	H	H	L
5ms	L	H	H	H	700uA	L	H	H	L
2ms	H	L	L	H	1.75mA	L	H	H	L
1ms	H	L	H	H	3.5mA	L	H	H	L
.5ms	L	L	L	L	8uA	H	L	H	L
.2ms	L	L	H	L	18uA	H	L	H	L
.1ms	L	H	L	L	35uA	H	L	L	L
50us	L	L	L	H	70uA	H	L	L	L
20us	L	L	H	H	175uA	H	L	L	L
10us	L	H	L	H	350uA	H	L	L	L
5us	L	H	H	H	700uA	H	L	L	L
2us	H	L	L	H	1.75mA	H	L	L	L
1us	H	L	H	H	3.5mA	H	L	L	L
.5us	L	L	L	H	70uA	L	L	L	L
.2us	L	L	H	H	175uA	L	L	L	L
.1us	L	H	L	H	350uA	L	L	L	L
50ns	L	H	H	H	700uA	L	L	L	L
20ns	H	L	L	H	1.75mA	L	L	L	L

Diagram 17

This diagram indicates the timing circuits for the DTB. It is basically identical to the diagram of the MTB. For a description refer to the explanation of the corresponding circuit parts in diagram 16. The additional parts in this diagram are explained below.

The point where the input signals for the final X amplifier are applied is present on this diagram. This point is formed by the emitters of V7031 and V7032. The balanced signals that are applied are the combined MTB and DTB outputs TBXOUT0/TBXOUT1 and the external X-DEFLection signals TBXOUT0-XA/TBXOUT1-XA.

The circuit with N7016 makes an accurate voltage +15TBREF for the MTB and DTB timing circuits. Also the TBCALREF voltage for time base calibration is made here. As a reference for this circuit the +10VREF is used.

The circuit with D7005 converts the 5 digital 0V/5V signals into one analog signal with 32 possible levels. This signal can be read by an analog input of the microprocessor.

The circuit with multiplexer D7004 selects accurate voltages that come from a divider network with precision resistors R7064 through R7067. Operational amplifier N7014/2,3,6 is supplied with these voltages in order to calibrate the X-path from the MTB.
Operational amplifier N7015/2,3,6 does the same for DTB. Voltage DSW (present at the DTB output) is made equal to the selected voltage from the voltage divider R7064 through R7067. This occurs via feedback signal DCLOOP. This gives a defined input voltage for the X-path (including the D7011

output stage). The output voltage XCAL at the horizontal deflection plates of the CRT is measured and horizontal calibrations are performed. During normal oscilloscope functioning the multiplexer connects pin 3 + 4 and pin 13 + 11. This switches V7093 and V7094 on and the feedback paths for MTB and DTB are interrupted.

The table shows the active delayed time base sections as a function of time/div setting:

delayed time base						
Time	Current source				Charge	Timing capacitor
/div	DTBI2	.I1	.I0	.I10	Current V7005/c	C7012 DTBC2
.5ms	L	L	L	L	8uA	H
.2ms	L	L	H	L	18uA	H
.1ms	L	H	L	L	35uA	H
50us	L	L	L	H	70uA	H
20us	L	L	H	H	175uA	H
10us	L	H	L	H	350uA	H
5us	L	H	H	H	700uA	H
2us	H	L	L	H	1.75mA	H
1us	H	L	H	H	3.5mA	H
.5us	L	L	L	H	70uA	L
.2us	L	L	H	H	175uA	L
.1us	L	H	L	H	350uA	L
50ns	L	H	H	H	700uA	L
20ns	H	L	L	H	1.75mA	L

5.1.2 Signal name list

Note: In the signal name list you find the itemnumber of the component that is source or destination. Behind this itemnumber (separated by ":") you find the number of the diagram where the source/destination can be found.

NAME	MEANING	SOURCE	DESTINATION
ALTCLK	ALTERNATE DISPLAY MODE CLOCK	V8018:15	V5503:10
ATCAL	SIGNAL FOR GAIN CALIBRATION	N1104:05	R1008:01 R2008:02 R3008:03 R4008:04
AT1AC/DC	AC/DC INPUT COUPLING SELECTION CH1	D9001:11	K1002:01
AT1LFCAL	LF CORRECTION CONTROL SIGNAL CH1	N9001:11	R1102:05
AT1LFCOR0	LF CORRECTION 0 CH1	N1102:05	R1029:01
AT1LFCOR1	LF CORRECTION 1 CH1	N1103:05	R1028:01
AT1LOOPCAL	LF GAIN CONTROL CH1	N9001:11	R1113:05
AT1LOOPCOR	LF GAIN CONTROL IN FEEDBACK LOOP CH1	R1113:05	V1001:01
AT1OFFSET	OFFSET CONTROL SIGNAL CH1	N9001:11	R1039:01
AT1OUT0	ATTENUATOR 1 OUTPUT 0 CH1	R1074:01	D1201:06
AT1OUT1	ATTENUATOR 1 OUTPUT 1 CH1	V1013:01	D1201:06
AT1PROBE	PROBE DETECTION SIGNAL CH1	X1002:01	R1096:05
AT1PROT	50Ω PROTECTION CH1	R1011:01	N1101:05

NAME	MEANING	SOURCE	DESTINATION
AT1.50E	50Ω INPUT IMPEDANCE SELECTION CH1	D9001:11	K1001:01
AT1/001	/1 ATTENUATOR SELECTION CH1	D9001:11	K1003:01
AT1/010	/10 ATTENUATOR SELECTION CH1	D9001:11	K1004:01
AT1/100	/100 ATTENUATOR SELECTION CH1	D9001:11	K1006:01
AT1/2.5	/2.5 ATTENUATOR SELECTION CH1	D9001:11	V1017:01
AT12REP	COMMON FOR ALL RELAIS CH 1, 2	D9001:11	K1001... K1006:01 K2001... K2006:02
AT2AC/DC	AC/DC INPUT COUPLING SELECTION CH2	D9001:11	K2002:02
AT2LFCAL	LF CORRECTION CONTROL SIGNAL CH2	N9001:11	R2102:05
AT2LFCOR0	LF CORRECTION 0 CH2	N1102:05	R2029:02
AT2LFCOR1	LF CORRECTION 1 CH2	N1103:05	R2028:02
AT2LOOPCAL	LF GAIN CONTROL CH2	N9001:11	R2113:05
AT2LOOPCOR	LF GAIN CONTROL IN FEEDBACK LOOP CH2	R2113:05	V2001:02
AT2OFFSET	OFFSET CONTROL SIGNAL CH2	N9002:11	R2039:02
AT2OUT0	ATTENUATOR 2 OUTPUT 0 CH2	R2074:02	D2201:06
AT2OUT1	ATTENUATOR 2 OUTPUT 1 CH2	V2113:02	D2201:06
AT2PROBE	PROBE DETECTION SIGNAL CH2	X2002:02	R2096:05
AT2PROT	50Ω PROTECTION CH2	R2011:02	N1101:05
AT2.50E	50Ω INPUT IMPEDANCE SELECTION CH2	D9001:11	K2001:02
AT2/001	/1 ATTENUATOR SELECTION CH2	D9001:11	K2003:02
AT2/010	/10 ATTENUATOR SELECTION CH2	D9001:11	K2004:02
AT2/100	/100 ATTENUATOR SELECTION CH2	D9001:11	K2006:02
AT2/2.5	/2.5 ATTENUATOR SELECTION CH2	D9001:11	V2017:02
AT3AC/DC	AC/DC INPUT COUPLING SELECTION CH3	D9002:11	K3002:03
AT3LFCAL	LF CORRECTION CONTROL SIGNAL CH3	N9003:11	R3102:05
AT3LFCOR0	LF CORRECTION 0 CH3	N3102:05	R3029:03
AT3LFCOR1	LF CORRECTION 1 CH3	N3103:05	R3028:03
AT3LOOPCAL	LF GAIN CONTROL CH3	N9003:11	R3113:05
AT3LOOPCOR	LF GAIN CONTROL IN FEEDBACK LOOP CH3	R3113:05	V3001:03
AT3OFFSET	OFFSET CONTROL SIGNAL CH3	N9002:11	R3039:03
AT3OUT0	ATTENUATOR 3 OUTPUT 0 CH3	R3074:03	D3201:07
AT3OUT1	ATTENUATOR 3 OUTPUT 1 CH3	V3013:03	D3201:07
AT3PROBE	PROBE DETECTION SIGNAL CH3	X3002:03	R3096:05
AT3PROT	50Ω PROTECTION CH3	R3011:03	N1101:05
AT3.50E	50Ω INPUT IMPEDANCE SELECTION CH3	D9002:11	K3001:03
AT3/001	/1 ATTENUATOR SELECTION CH3	D9002:11	K3003:03
AT3/010	/10 ATTENUATOR SELECTION CH3	D9002:11	K3004:03
AT3/100	/100 ATTENUATOR SELECTION CH3	D9002:11	K3006:03
AT3/2.5	/2.5 ATTENUATOR SELECTION CH3	D9002:11	V3016:03
AT34REP	COMMON FOR ALL RELAIS CH 3, 4	D9002:11	K3001... K3006:03 K4001... K4006:04
AT4AC/DC	AC/DC INPUT COUPLING SELECTION CH4	D9002:11	K4002:04
AT4LFCAL	LF CORRECTION CONTROL SIGNAL CH4	N9003:11	R4102:05
AT4LFCOR0	LF CORRECTION 0 CH4	N3102:05	R4029:04
AT4LFCOR1	LF CORRECTION 1 CH4	N3103:05	R4028:04
AT4LOOPCAL	LF GAIN CONTROL CH4	N9003:11	R4113:05
AT4LOOPCOR	LF GAIN CONTROL IN FEEDBACK LOOP CH4	R4113:05	V4001:04

NAME	MEANING	SOURCE	DESTINATION
AT4OFFSET	OFFSET CONTROL SIGNAL CH4	N9003:11	R4039:04
AT4OUT0	ATTENUATOR 4 OUTPUT 0 CH4	R4074:04	D4201:07
AT4OUT1	ATTENUATOR 4 OUTPUT 1 CH4	R4013:04	D4201:07
AT4PROBE	PROBE DETECTION SIGNAL CH4	X4002:04	R4096:05
AT4PROT	50Ω PROTECTION CH4	R4011:04	N1101:05
AT4.50E	50Ω INPUT IMPEDANCE SELECTION CH4	D9002:11	K4001:04
AT4/001	/1 ATTENUATOR SELECTION CH4	D9002:11	K4003:04
AT4/010	/10 ATTENUATOR SELECTION CH4	D9002:11	K4004:04
AT4/100	/100 ATTENUATOR SELECTION CH4	D9002:11	K4006:04
AT4/2.5	/2.5 ATTENUATOR SELECTION CH4	D9002:11	V4017:04
CNT1CH-HX	CHANNEL 1 ON/OFF SIGNAL	R5559:10	D1301:08
CNT1DT-HT	DTB TRIGGER ON CH1 ON/OFF	D5502:10	D1301:08
CNT1MT-HT	MTB TRIGGER ON CH1 ON/OFF	D5501:10	D1301:08
CNT2CH-HX	CHANNEL 2 ON/OFF SIGNAL	R5558:10	D2301:08
CNT2DT-HT	DTB TRIGGER ON CH2 ON/OFF	D5502:10	D2301:08
CNT2MT-HT	MTB TRIGGER ON CH2 ON/OFF	D5501:10	D2301:08
CNT3CH-HX	CHANNEL 3 ON/OFF SIGNAL	R5557:10	D3301:08
CNT3DT-HT	DTB TRIGGER ON CH3 ON/OFF	D5502:10	D3301:08
CNT3MT-HT	MTB TRIGGER ON CH3 ON/OFF	D5501:10	D3301:08
CNT4CH-HX	CHANNEL 4 ON/OFF SIGNAL	R5556:10	D4301:08
CNT4DT-HT	DTB TRIGGER ON CH4 ON/OFF	D5502:10	D4301:08
CNT4MT-HT	MTB TRIGGER ON CH4 ON/OFF	D5501:10	D4301:08
CPBLANK-HX	CHOPPER BLANKING SIGNAL	R5517:10	C8002:15
DLDOFFSET	DELAY LINE DRIVER OFFSET	N9003:11	R5018:09
DLDOUT0	DELAY LINE DRIVER OUTPUT 0	R5063:09	DELAY LINE
DLDOUT1	DELAY LINE DRIVER OUTPUT 1	R5062:09	DELAY LINE
DLEN0-HT	DATA LATCH ENABLE 0	X9001:18	D9001:11
DLEN1-HT	DATA LATCH ENABLE 1	X9001:18	D9002:11
DLEN2-HT	DATA LATCH ENABLE 2	X9001:18	D9006:16
DSOD	SET OF FLIPFLOP AUTOPOS Y-CURSOR	D8004:15	R8057:15
DTBCALTST	DTB CAL TEST SIGNAL	D7011:17	D7005:17
DTBVAR	DTB VARIABLE CONTROL SIGNAL	N8005:15	R7009:17
DTBGATE	DTB GATE SIGNAL	V8011:15	D7011:17
DTRHF-HD	DELAYED TRIGGER HF FILTER SWITCH	D9012:14	R7544:14
DTRIG0	DELAYED TRIGGER OUTPUT SIGNAL 0	V7574:14	D8004:15
DTRIG1	DELAYED TRIGGER OUTPUT SIGNAL 1	V7573:14	D8004:15
DTRLF-HD	DELAYED TRIGGER LF FILTER SWITCH	D9007:17	R7542:14
DTRLINE	X-DEFLECTION VIA LINE SIGNAL	D7711:13	V7506:14
DTRLINESW-HD	X-DEFLECTION VIA LINE SWITCHING	D9012:14	D7711:13
DTRSEN	DELAYED TRIGGER SENSITIVITY CONTROL	N8005:15	R7554:14
DTRSLOPE	DELAYED TRIGGER SLOPE CONTROL	D9007:17	R7547:14
DTRTVL	DELAYED TRIGGER TV LINE TRIG SIGNAL	D7711:13	R7696:14
DTRTVSEL-HD	DELAYED TV TRIGGER SELECTION	R7543:14	D7711:13
DTRXDEF0	DELAYED TRIGGER X DEFLECTION SIGNAL 0	D7541:14	R7754:14
DTRXDEF1	DELAYED TRIGGER X DEFLECTION SIGNAL 1	D7541:14	R7753:14
DTRXDSEL-HD	DELAYED TRIGGER X DEFLECTION SELECTION	D9012:14	R7546:14
FNCBWL	BANDWIDTH LIMITER ON/OFF	D9003:11	D1301:08 D2301:08 D3301:08 D4301:08

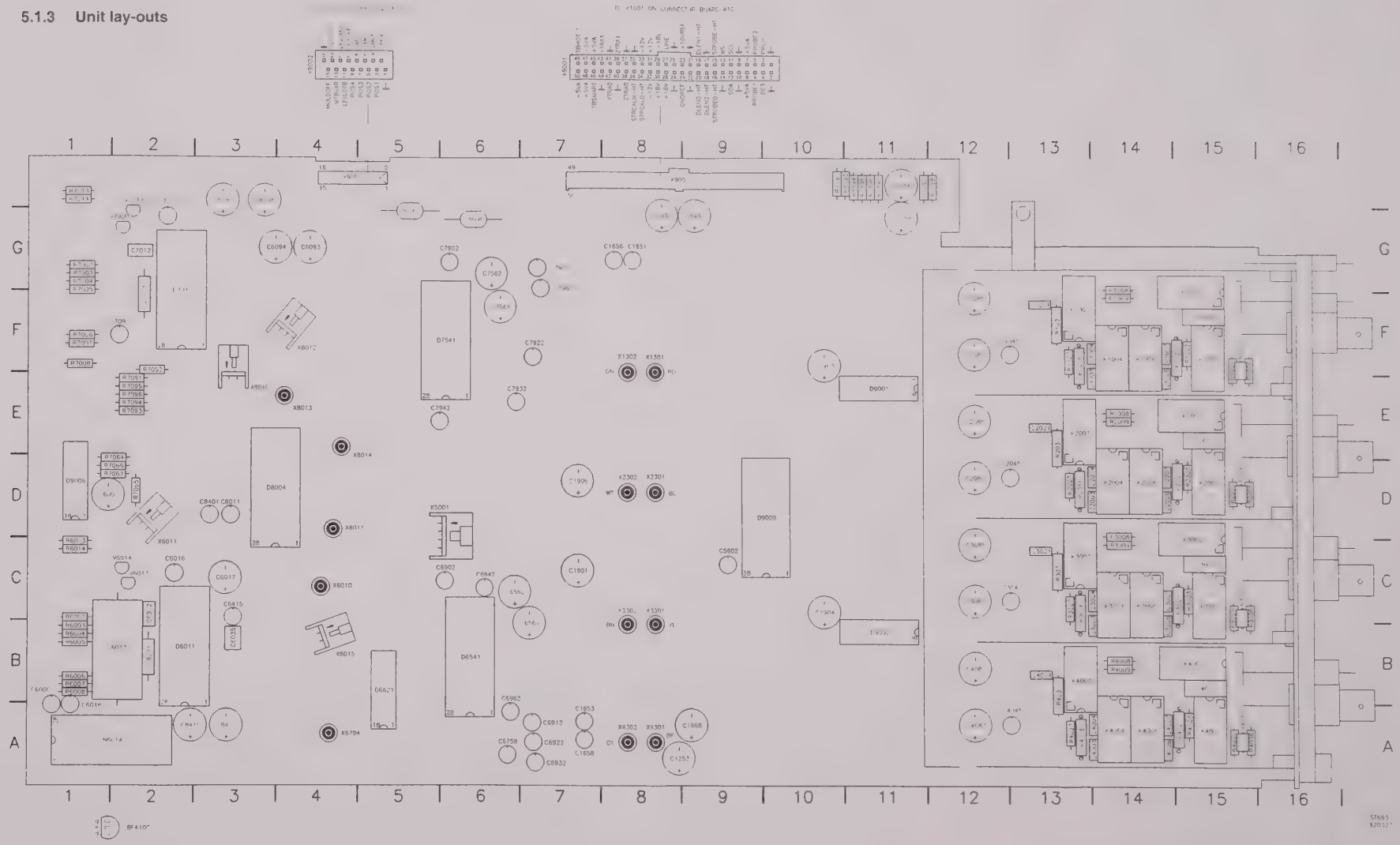
NAME	MEANING	SOURCE	DESTINATION
FNC1DTR0	DTB TRIGGER ON CH1 OUTPUT SIGNAL 0	D1301:08	R7522:14
FNC1DTR1	DTB TRIGGER ON CH1 OUTPUT SIGNAL 1	D1301:08	R7521:14
FNC1MTR0	MTB TRIGGER ON CH1 OUTPUT SIGNAL 0	D1301:08	R6522:12
FNC1MTR1	MTR TRIGGER ON CH1 OUTPUT SIGNAL 1	D1301:08	R6521:12
FNC1OUT0	CHANNEL 1 OUTPUT SIGNAL 0	D1301:08	R1313:09
FNC1OUT1	CHANNEL 1 OUTPUT SIGNAL 1	D1301:08	R1314:09
FNC2DTR0	DTB TRIGGER ON CH2 OUTPUT SIGNAL 0	D2301:08	R7524:14
FNC2DTR1	DTB TRIGGER ON CH2 OUTPUT SIGNAL 1	D2301:08	R7523:14
FNC2MTR0	MTB TRIGGER ON CH2 OUTPUT SIGNAL 0	D2301:08	R6524:12
FNC2MTR1	MTR TRIGGER ON CH2 OUTPUT SIGNAL 1	D2301:08	R6523:12
FNC2OUT0	CHANNEL 2 OUTPUT SIGNAL 0	D2301:08	R2313:09
FNC2OUT1	CHANNEL 2 OUTPUT SIGNAL 1	D2301:08	R2314:09
FNC3DTR0	DTB TRIGGER ON CH3 OUTPUT SIGNAL 0	D3301:08	R7527:14
FNC3DTR1	DTB TRIGGER ON CH3 OUTPUT SIGNAL 1	D3301:08	R7526:14
FNC3MTR0	MTB TRIGGER ON CH3 OUTPUT SIGNAL 0	D3301:08	R6527:12
FNC3MTR1	MTR TRIGGER ON CH3 OUTPUT SIGNAL 1	D3301:08	R6526:12
FNC3OUT0	CHANNEL 3 OUTPUT SIGNAL 0	D3301:08	R3313:09
FNC3OUT1	CHANNEL 3 OUTPUT SIGNAL 1	D3301:08	R3314:09
FNC4DTR0	DTB TRIGGER ON CH4 OUTPUT SIGNAL 0	D4301:08	R7529:14
FNC4DTR1	DTB TRIGGER ON CH4 OUTPUT SIGNAL 1	D4301:08	R7528:14
FNC4MTR0	MTB TRIGGER ON CH4 OUTPUT SIGNAL 0	D4301:08	R6529:12
FNC4MTR1	MTR TRIGGER ON CH4 OUTPUT SIGNAL 1	D4301:08	R6528:12
FNC4OUT0	CHANNEL 4 OUTPUT SIGNAL 0	D4301:08	R4313:09
FNC4OUT1	CHANNEL 4 OUTPUT SIGNAL 1	D4301:08	R4314:09
FNCYOP0	Y-OUT OPTION SIGNAL 0	D1301:08	Y-option
FNCYOP1	Y-OUT OPTION SIGNAL 1	D1301:08	Y-option
HOLDOFF	HOLD OFF CONTROL SIGNAL	X9002:18	R6032:16
INTTRA	TRACE INTENSITY CONTROL	X9002:18	R8049:15
LEVDTB	DELAYED TRIGGER LEVEL CONTROL	X9002:18	R7681:14
LEVMTB	MAIN TRIGGER LEVEL CONTROL	X9002:18	R6622:12
LINE	LINE TRIGGER SIGNAL	X9001:18	R7711:13
MTBCALTST	MTB CAL TEST SIGNAL	D6011:16	D7005:17
MTBGATE	MTB GATE SIGNAL	V8014:15	D6011:16
MTBVAR	MTB VARIABLE CONTROL SIGNAL	X9002:18	R6009:16
MTRBAL	MAIN TRIGGER BALANCE	N8005:15	R6709:12
MTRHF-HD	MAIN TRIGGER HF FILTER SWITCH	D9008:15	R6544:12
MTRIG0	MAIN TRIGGER OUTPUT SIGNAL 0	V6574:12	D8004:15
MTRIG1	MAIN TRIGGER OUTPUT SIGNAL 1	V6573:12	D8004:15
MTRLF-HD	MAIN TRIGGER LF FILTER SWITCH	D9011:12	R6542:12
MTRLINE	MAIN TRIGGER LINE TRIGGER SIGNAL	D5001:13	V6506:12
MTRPPLEV-HD	MAIN TRIGGERING AUTO PP OFF	D9011:12	V6628:12
MTRSEN	MAIN TRIGGER SENSITIVITY CONTROL	N8005:15	R6554:12
MTRSLOPE	MAIN TRIGGER SLOPE CONTROL	D9011:12	R6547:12
MTRTVMODE	MAIN TRIGGER TV SYSTEM SELECTION	N8005:15	R6772:13
MTRTVSEL-HD	MAIN TV TRIGGER SELECTION	D9011:12	V6757:13
MTRVIDEO	MAIN TV TRIGGER INPUT SIGNAL	D6541:12	V6754:13

NAME	MEANING	SOURCE	DESTINATION
PA1/2	ATTENUATION /2 CONTROL CH1	D9003:11	D1201:06
PA1ICL	CLAMP LEVEL CURRENT CH1	V1206:06	D1201:06
PA1ISY	SUPPLY CURRENT CH1	V1207:06	D1201:06
PA1LSA	LEVEL SHIFT A CH1	V1208:06	R1216:06
PA1LSB	LEVEL SHIFT B CH1	V1209:06	R1217:06
PA1OFFSET	OFFSET INPUT CIRCUIT CH1	N9001:11	R1203:06
PA1OFFSTRG	OFFSET LEVEL SHIFTER CH1	N9001:11	R1229:06
PA1OUT0	OUTPUT SIGNAL 0 CH1	V1202:06	R1301:08
PA1OUT1	OUTPUT SIGNAL 1 CH1	V1201:06	R1302:08
PA1X1	GAIN X1 CONTROL CH1	D9003:11	D1201:06
PA1X5	GAIN X5 CONTROL CH1	D9003:11	D1201:06
PAVREF	PREAMPL REFERENCE VOLTAGE	N1251:06	R1200:06 R2200:06 R3200:07 R4200:07
PA2/2	ATTENUATION /2 CONTROL CH2	D9003:11	D2201:06
PA2ICL	CLAMP LEVEL CURRENT CH2	V2206:06	D2201:06
PA2ISY	SUPPLY CURRENT CH2	V2207:06	D2201:06
PA2LSA	LEVEL SHIFT A CH2	V2208:06	R2216:06
PA2LSB	LEVEL SHIFT B CH2	V2209:06	R2217:06
PA2OFFSET	OFFSET INPUT CIRCUIT CH2	N9002:11	R2203:06
PA2OFFSTRG	OFFSET LEVEL SHIFTER CH2	N9002:11	R2229:06
PA2OUT0	OUTPUT SIGNAL 0 CH2	V2202:06	R2301:08
PA2OUT1	OUTPUT SIGNAL 1 CH2	V2201:06	R2302:08
PA2X1	GAIN X1 CONTROL CH2	D9003:11	D2201:06
PA2X5	GAIN X5 CONTROL CH2	D9003:11	D2201:06
PA3/2	ATTENUATION /2 CONTROL CH3	D9004:11	D3201:07
PA3ICL	CLAMP LEVEL CURRENT CH3	V3206:07	D3201:07
PA3ISY	SUPPLY CURRENT CH3	V3207:07	D3201:07
PA3LSA	LEVEL SHIFT A CH3	V3208:07	R3216:07
PA3LSB	LEVEL SHIFT B CH3	V3209:07	R3217:07
PA3OFFSET	OFFSET INPUT CIRCUIT CH3	N9003:11	R3203:07
PA3OFFSTRG	OFFSET LEVEL SHIFTER CH3	N9003:11	R3229:07
PA3OUT0	OUTPUT SIGNAL 0 CH3	V3202:07	R3301:08
PA3OUT1	OUTPUT SIGNAL 1 CH3	V3201:07	R3302:08
PA3X1	GAIN X1 CONTROL CH3	D9004:11	D3201:07
PA3X5	GAIN X5 CONTROL CH3	D9004:11	D3201:07
PA4/2	ATTENUATION /2 CONTROL CH4	D9004:11	D4201:07
PA4ICL	CLAMP LEVEL CURRENT CH4	V4206:07	D4201:07
PA4ISY	SUPPLY CURRENT CH4	V4207:07	D4201:07
PA4LSA	LEVEL SHIFT A CH4	V4208:07	R4216:07
PA4LSB	LEVEL SHIFT B CH4	V4209:07	R4217:07
PA4OFFSET	OFFSET INPUT CIRCUIT CH4	N9003:11	R4203:07
PA4OFFSTRG	OFFSET LEVEL SHIFTER CH4	N9003:11	R4229:07
PA4OUT0	OUTPUT SIGNAL 0 CH4	V4202:07	R4301:08
PA4OUT1	OUTPUT SIGNAL 1 CH4	V4201:07	R4302:08
PA4X1	GAIN X1 CONTROL CH4	D9004:11	D4201:07
PA4X5	GAIN X5 CONTROL CH4	D9004:11	D4201:07
POS1	POSITION CONTROL CH1	X9002:18	R1308:08
POS2	POSITION CONTROL CH2	X9002:18	R2308:08

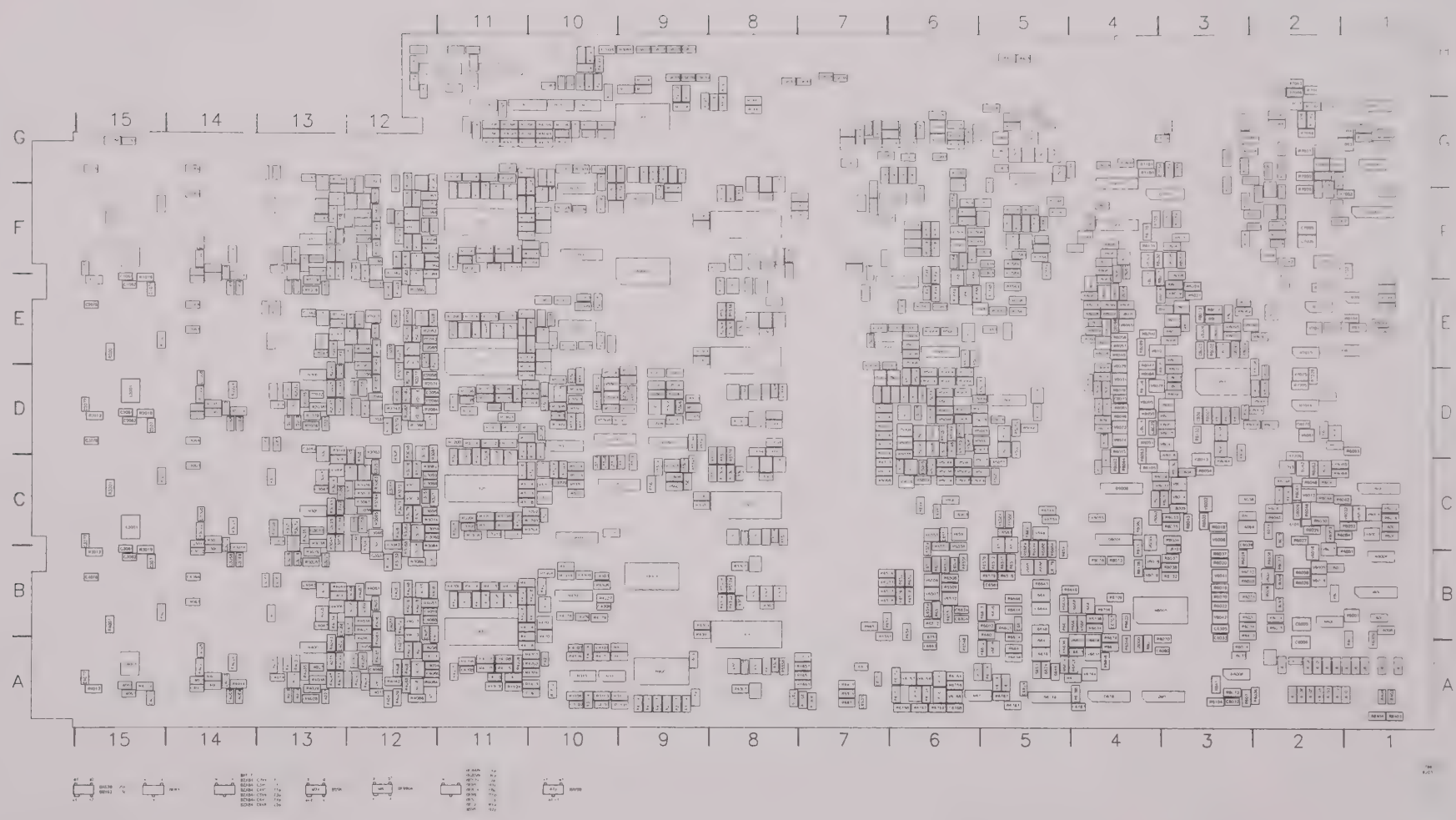
NAME	MEANING	SOURCE	DESTINATION
POS3	POSITION CONTROL CH3	X9002:18	R3308:08
POS4	POSITION CONTROL CH4	X9002:18	R4308:08
PROBE1	PROBE DETECTION/50Ω PROTECTION CH1	R1093:05	X9001:18
PROBE2	PROBE DETECTION/50Ω PROTECTION CH2	R2093:05	X9001:18
PROBE3	PROBE DETECTION/50Ω PROTECTION CH3	R3093:05	X9001:18
PROBE4	PROBE DETECTION/50Ω PROTECTION CH4	R4093:05	X9001:18
SCL	SERIAL CLOCK	X9001:18	D9009:10
			D9001:11
			D9002:11
			D9003:11
			D9004:11
			D9006:16
			D9007:17
			D9008:15
			D9011:12
			D9012:14
			N8005:15
			N9001:11
			N9002:11
			N9003:11
			R8403:16
SDA	SERIAL DATA	X9001:18	D9009:10
			D9001:11
			D9002:11
			D9003:11
			D9004:11
			D9006:16
			D9011:12
			N8005:15
			N9001:11
			N9002:11
			N9003:11
			R8404:16
STRCALD-HT	RESET FLIPFLOP AUTOPOS Y-CURSOR	X9001:18	V8065:15
			V8007:15
STROBE0-HT	STROBE/ENABLE SIGNAL 0	X9001:18	D9003:11
			D9004:11
STROBE1-HT	STROBE/ENABLE SIGNAL 1	X9001:18	D9007:17
			D9008:15
			D9011:12
			D9012:14
TBAUTO-LD	TIME BASE AUTO FREE RUN CONTROL	D9007:17	D8004:15
TBCALREF	TIME BASE CALIBRATION REFERENCE	V7011:17	D6011:16
			D7011:17
TBD01	TIME BASE SERIAL DATA 01	D9011:12	D9008:15
TBD02	TIME BASE SERIAL DATA 02	D9008:15	D9007:17
TBD03	TIME BASE SERIAL DATA 03	D9007:17	D9012:14
TBEOM-HX	TIME BASE END OF MAIN SWEEP	D6011:16	D8004:15
TBEOD-HX	TIME BASE END OF DELAYED SWEEP	D7011:17	D8004:15
TBEOHO-LX	TIME BASE END OF HOLD OFF	D6011:16	D8004:15
TBHOTXT	TIME BASE HOLD OFF FOR TEXT DISPLAY	R8026:15	X9001:18
TBINTRAT-XA	INTENS RATIO CONTROL SIGNAL	N8005:15	R8007:15

NAME	MEANING	SOURCE	DESTINATION
TBNOTTR-HT	TIME BASE NOT TRIGGERED SIGNAL	D8004:15	D7005:17
TDADA	TIME BASE SERIAL DATA	R8404:16	N6014:16
TDACL	TIME BASE SERIAL CLOCK	R8403:16	D9006:16
			D9007:17
			D9008:15
			D9011:12
			D9012:14
			N6013:16
			N8005:15
TBSEL	TIME BASE MTB/DTB SELECTION	R5501:10	R6018:16
			R7028:17
			R8072:15
TBSTD-LX	TIME BASE START OF DTB	D6011:16	D8004:15
TBSSG-HT	TIME BASE END OF SINGLE SWEEP	D8004:15	D7005:17
TBSMART	TIME BASE TEST SIGNALS	C7054:17	X9001:18
TBXDEFL-LD	X DEFLECTION CONTROL SIGNAL	D9012:14	V8015:15
			R7772:
TBXOUT0	TIME BASE OUTPUT 0	D6011:16	R7077:17
		D7011:17	
TBXOUT0-XA	X DEFLECTION OUTPUT 0	R7754:14	V7031:17
TBXOUT1	TIME BASE OUTPUT 1	D6011:16	R7078:17
		D7011:17	
TBXOUT1-XA	X DEFLECTION OUTPUT 1	R7753:14	V7032:17
TBXPOS	TIME X POSITION	R8411:16	R6017:16
			R7099:17
TRASEP	ANALOG TRACE SEPARATION SIGNAL	X9002:18	R5021:09
TRASEP-HC	DIGITAL TRACE SEPARATION CONTROL	R5524:10	D5001:09
VAR1	VARIABLE GAIN CONTROL CH1	X9002:18	R1211:06
VAR2	VARIABLE GAIN CONTROL CH2	X9002:18	R2211:06
VAR3	VARIABLE GAIN CONTROL CH3	X9002:18	R3211:07
VAR4	VARIABLE GAIN CONTROL CH4	X9002:18	R4211:07
VPPTEST-LD	VOLT PP TEST AUTOPOS Y-CURSOR	V8066:15	D7005:17
XTRA0	X DEFLECTION OUTPUT SIGNAL 0	V7150:17	X9001:18
XTRA1	X DEFLECTION OUTPUT SIGNAL 1	V7151:17	X9001:18
ZTRA0	INTENSITY OUTPUT SIGNAL 0	D8003:15	X9001:18
ZTRA1	INTENSITY OUTPUT SIGNAL 1	D8003:15	X9001:18

5.1.3 Unit lay-outs



Lay-out 1 - Large component side of signal unit A1



Lay-out 2 - Small component side of signal unit A1

5.1.4 Location list Signal Unit A1

'-L' means that the component is located on the side with the large components. Otherwise the component is located on the side with small components (SMD's: surface mounted devices)

C1001 F15-L
C1002 F14
C1003 F14-L
C1004 F14-L
C1005 F15
C1006 F14-L
C1007 F14-L
C1008 F14
C1011 F14
C1012 F14
C1014 F13
C1018 E13
C1019 E13
C1021 F13-L
C1022 F13
C1023 F13
C1025 F13
C1027 E13
C1041 G13
C1042 G13
C1044 F12
C1045 F13-L
C1046 F12
C1047 F13
C1048 G12
C1049 G13
C1051 F12
C1054 F12
C1055 F12
C1056 F12
C1057 F12
C1058 F12
C1059 F12
C1060 F12
C1061 F15
C1062 E15
C1063 F14
C1064 G14
C1066 G13
C1067 G13
C1068 E14
C1069 E14
C1071 E15
C1076 G15
C1077 F15
C1082 H10
C1085 G12-L
C1086 F13
C1087 F12-L
C1088 F12
C1101 G10
C1102 G10
C1151 H12
C1152 H11
C1153 G15
C1156 H11-L
C1157 H11
C1158 H11-L
C1159 G11
C1201 F10
C1204 G11
C1205 F11
C1208 F10
C1209 F10
C1210 F11
C1211 F11
C1250 G10
C1251 G9
C1252 G9
C1254 A9
C1301 F8
C1302 F8
C1303 G10
C1304 F8
C1305 F8
C1651 G8-L
C1653 A7-L
C1654 D8
C1656 G8-L
C1657 D8
C1658 A7-L
C1659 D8
C1661 D8
C1662 D8
C1669 A9
C1901 C7-L
C1903 F10-L
C1904 C10-L
C1906 D7-L
C1931 H8-L
C1932 H8-L
C2001 E15-L
C2002 D14
C2003 D14-L
C2004 D14-L
C2005 D15
C2006 D14-L
C2007 D14-L
C2008 D14
C2011 D14
C2012 D14
C2014 D13
C2018 D13
C2019 D13
C2021 E13-L
C2022 D13
C2023 D13
C2025 D13
C2027 D13
C2031 D12
C2041 E13
C2042 E13
C2044 D12
C2045 D13-L
C2046 D12
C2047 E13
C2048 E12
C2051 E12
C2054 D12
C2055 E12
C2056 D12
C2057 E12
C2058 D12
C2059 E12
C2060 D12
C2061 D15
C2062 D15
C2063 E14
C2064 E14
C2066 E13
C2067 E13
C2068 D14
C2069 D14
C2071 D15
C2072 D14
C2076 E15
C2077 D15
C2085 E12-L
C2086 E13
C2087 D12-L
C2088 E12
C2101 H10
C2102 H10
C2201 D10
C2204 E11
C2205 D11
C2208 E10
C2209 E10
C2210 D11
C2211 D11
C2301 E8
C2302 E8
C2303 E10
C2304 D8
C2305 D8
C3001 C15-L
C3002 B14
C3003 B14-L
C3004 C14-L
C3005 C15
C3006 D14-L
C3007 C14-L
C3008 C14
C3011 C14
C3012 B14
C3014 C13
C3018 B13
C3019 B13
C3021 C13-L
C3022 C13
C3023 C13
C3025 C13
C3027 B13
C3031 B12
C3041 D13
C3042 D13
C3044 C12
C3045 C13-L
C3046 C12
C3047 C13
C3048 D12
C3051 C12
C3054 C12
C3055 C12
C3056 C12
C3057 C12
C3058 C12
C3059 C12
C3060 C12
C3061 C15
C3062 B15
C3063 C14
C3064 D14
C3066 D13
C3067 D13
C3068 B14
C3069 B14
C3071 B15
C3072 C14
C3076 D15
C3077 C15
C3085 C12-L
C3086 C13
C3087 C12-L

C3088 C12
C3101 A10
C3102 A10
C3201 C10
C3204 D11
C3205 C11
C3208 D10
C3209 C10
C3210 C11
C3211 C11
C3301 C8
C3302 C8
C3303 D10
C3304 C8
C3305 C8
C4001 B15-L
C4002 A14
C4003 A14-L
C4004 A14-L
C4005 A15
C4006 A14-L
C4007 A14-L
C4008 A14
C4011 A14
C4012 A14
C4014 A13
C4018 A13
C4019 A13
C4021 B13-L
C4022 A13
C4023 A13
C4025 A13
C4027 A13
C4031 A12
C4041 B13
C4042 B13
C4044 A12
C4045 A13-L
C4046 A12
C4047 B13
C4051 B12
C4054 A12
C4055 B12
C4056 A12
C4057 B12
C4058 A12
C4059 B12
C4060 A12
C4061 A15
C4062 A15
C4063 B14
C4064 B14
C4066 B13
C4067 B13
C4068 A14
C4069 A14
C4071 A15
C4076 B15
C4077 A15
C4085 B12-L
C4086 B13
C4087 A12-L
C4088 B12
C4101 A10
C4102 A10
C4201 A10
C4204 B11
C4205 A11
C4208 B10
C4209 B10
C4210 A11
C4211 A11
C4301 B8
C4302 B8
C4304 B10
C4304 A8
C4305 A8
C5000 E5
C5001 E7
C5002 E6
C5003 E6
C5004 C6
C5005 C6
C5006 D6
C5007 C6
C5008 E7
C5010 D6
C5012 D6
C5013 D6
C5016 D5
C5017 C6
C5018 D6
C5501 D9
C5502 D10
C5503 D10
C5504 C9
C5505 D9
C5506 D9
C5507 D10
C5508 C10
C5509 C10
C5510 C10
C5511 C10
C5513 D9
C5601 D9
C5602 C9-L
C5603 C9
C5604 C9
C6000 B1-L
C6001 D2-L
C6002 B1
C6004 B2
C6005 B2
C6007 C1
C6008 A2
C6008 B1
C6009 C2
C6011 B2-L
C6012 C2-L
C6013 B2-L
C6014 C2
C6015 C2
C6016 C2-L
C6017 C3-L
C6018 B1-L
C6031 A3
C6032 A3
C6033 B3
C6035 B3-L
C6038 C3
C6039 C3
C6062 D2
C6070 C4
C6071 B2
C6080 A4
C6093 G4-L
C6094 G4-L
C6095 B2
C6096 H3-L
C6097 H3-L
C6098 C3
C6101 A2
C6102 A2
C6103 A2
C6104 A2
C6105 A2
C6106 A2
C6107 A2
C6108 A2
C6109 A2
C6110 A2
C6111 A2
C6112 A2
C6113 A2
C6114 A1
C6115 A1
C6116 A1
C6117 A1
C6118 A2
C6305 B3
C6415 C3-L
C6504 B6
C6549 B6
C6551 B6
C6557 C6
C6559 C6
C6561 C7-L
C6562 C6-L
C6581 B5
C6583 C5
C6617 B5
C6623 A5
C6624 A5
C6639 A5
C6644 B5
C6647 B5
C6648 B5
C6649 A5
C6707 B4
C6751 B6
C6758 A6-L
C6768 A6
C6773 A5
C6777 A6
C6779 B5
C6783 A5
C6787 A5
C6902 C6-L
C6903 C6
C6904 B6
C6912 A7-L
C6913 A7
C6922 A7-L
C6923 A7
C6924 A5
C6932 A7-L
C6933 A7
C6934 B6
C6942 C6-L
C6943 C6
C6953 A5
C6962 B6-L
C6963 A6
C7001 G1
C7002 F1
C7003 E1
C7004 F2
C7005 F2
C7006 F2
C7007 F2
C7008 F2
C7009 G2
C7010 F3
C7011 F2-L
C7012 G2-L
C7013 H2-L
C7014 G2
C7015 G6
C7016 F2
C7017 G2
C7021 H2
C7033 G3
C7034 F2
C7035 F2

C7036 G4
C7054 G4
C7055 G3
C7060 G7
C7091 F2-L
C7092 E2
C7093 D2
C7099 G3
C7504 F6
C7513 F6
C7549 F6
C7551 F6
C7557 F5
C7559 F6
C7561 F6-L
C7562 G6-L
C7581 F5
C7583 F5
C7682 E6
C7697 E6
C7751 G5
C7813 G5
C7902 G6-L
C7903 G6
C7904 F5
C7912 G7-L
C7913 G6
C7922 F7-L
C7923 F7
C7932 E6-L
C7933 E6
C7934 F5
C7942 E6-L
C7943 E5
C7962 G7-L
C7963 E6
C8000 A4
C8001 D3
C8002 D2
C8003 D3
C8004 D3
C8005 E3
C8006 E3
C8007 D4
C8008 F3
C8009 C3
C8010 C4
C8011 D3-L
C8013 D3
C8014 D4
C8015 D4
C8017 E1
C8020 E4
C8021 D3
C8022 D3
C8032 C4
C8034 G4
C8035 D4
C8036 F4
C8060 E4
C8062 F4
C8063 F4
C8064 E4
C8065 E4
C8066 E4
C8070 D2
C8071 F4
C8093 D4
C8094 D4
C8095 E3
C8101 C3
C8102 E3
C8401 D3-L
C8403 A1
C8404 A1
C8405 H5
C8410 A3-L
C8411 A3-L
C9011 H9
C9012 H9
C9015 H9
C9016 H9
C9018 H9
C9019 H9
C9020 H9
C9034 H7
C9036 H7
C9041 H8
C9042 H8
D1151 H12
D1152 H11
D1201 F11
D1301 F8
D2201 E11
D2301 E8
D3201 C11
D3301 C8
D4201 B11
D4301 B8
D5001 D5
D5501 C10
D5502 D10
D5503 D9
D6001 B1
D6002 C1
D6011 B2-L
D6541 B6-L
D6621 B5-L
D6779 A5
D6781 A4
D7001 F1
D7002 G1
D7004 E2
D7005 F3
D7541 F6-L
D8003 D3
D8006 C4
D9001 E11-L
D9002 B11-L
D9003 F10
D9004 C10
D9006 D1-L
D9007 F4
D9008 C4
D9009 D10-L
D9011 A4
D9012 G4
D9013 G5
K1001 F15-L
K1002 G15-L
K1003 F13-L
K1004 F14-L
K1006 F14-L
K2001 D15-L
K2002 D15-L
K2003 E13-L
K2004 D14-L
K2006 D14-L
K3001 C15-L
K3002 D15-L
K3003 C13-L
K3004 C14-L
K3006 C14-L
K4001 A15-L
K4002 B15-L
K4003 B13-L
K4004 A14-L
K4006 A14-L
L1001 F15
L2001 D15
L3001 C15
L4001 A15
L6096 G6-L
L6097 H5-L
N1001 F13
N1101 H11
N1102 G10
N1103 G10
N1104 G11
N1202 G10
N1251 F9
N2001 D13
N2202 E10
N3001 C13
N3102 A10
N3103 A10
N3202 D10
N4001 A13
N4204 B10
N5001 E7
N5002 E6
N6006 B1
N6007 B2
N6008 A3
N6014 A2-L
N6771 A6
N7006 G1
N7007 E1
N7014 D2
N7015 E2
N7016 E2
N7951 F6
N8005 B4
N9001 G9
N9002 F9
N9003 A9
N9004 B9
R1001 F15
R1002 F15
R1003 F15
R1006 F15-L
R1007 F15-L
R1008 G14-L
R1009 G14-L
R1010 F14
R1011 F15-L
R1012 F15
R1013 F13
R1014 F14
R1016 F14-L
R1019 F15
R1021 F15-L
R1022 F14
R1023 F15-L
R1024 F14
R1026 F13
R1027 F13-L
R1028 E13
R1029 E13
R1031 F13-L
R1031 F13-L
R1032 F13
R1033 F13
R1034 F13
R1035 F13
R1036 F12
R1037 F12
R1038 F13
R1042 F12
R1043 F13
R1044 F13
R1045 F13
R1046 F12
R1047 F12

R1048 G12
R1052 F13
R1053 F13
R1054 F13
R1056 F12
R1057 G12
R1061 G12
R1062 F12
R1063 F12
R1064 F12
R1065 F12
R1071 F12
R1072 F12
R1073 F12
R1074 F12
R1076 F12
R1077 F12
R1078 F12
R1079 F12
R1081 G12
R1082 F12
R1083 F12
R1084 F12
R1087 F12
R1088 F12
R1092 G11
R1093 G11
R1094 H10
R1095 G11
R1096 G11
R1097 H10
R1101 G10
R1102 G10
R1103 G10
R1104 G10
R1106 G10
R1112 H9
R1113 H9
R1114 H9
R1141 G11
R1151 H12
R1152 H11
R1153 H11
R1154 H11
R1155 H12
R1156 H12
R1157 H12-L
R1158 H12-L
R1159 H12
R1192 H10-L
R1193 H11-L
R1194 H11-L
R1195 H11-L
R1196 H11-L
R1197 H11-L
R1200 G11
R1201 F11
R1201 G11
R1202 F11
R1203 F11
R1204 H10
R1204 F11
R1205 F11
R1207 F11
R1208 F11
R1209 F11
R1210 F11
R1211 G11
R1212 G11
R1213 F11
R1214 F11
R1215 F11
R1216 F11
R1217 F11
R1218 F11
R1220 G11
R1222 G11
R1223 G11
R1224 G11
R1226 G11
R1227 G10
R1228 F10
R1229 F10
R1231 G10
R1251 G9
R1252 G9
R1253 G9
R1254 G9
R1256 G9
R1257 F9
R1258 G10
R1259 G10
R1260 G10
R1262 A7
R1266 A7
R1301 F9
R1302 F9
R1303 F8
R1304 F8
R1306 E8
R1307 E8
R1308 G10
R1309 G10
R1311 F8
R1312 F8
R1313 D7
R1314 D7
R1611 A10
R1611 A11
R1612 A10
R1613 A11
R1651 F8
R1652 A8
R1653 F8
R1654 A8
R1656 F8
R1657 A8
R1661 G8
R1662 H8
R1663 A8
R1901 G11
R1902 E10
R1903 D11
R1904 B10
R1906 A7
R1911 G10
R1912 E10
R1913 D11
R1914 B10
R1917 D11
R1921 G10
R1922 D11
R1923 B10
R1924 A11
R1926 F11
R1928 C11
R1929 A11
R1951 H9
R1961 H8
R2001 E15
R2002 E15
R2003 D15
R2006 D15-L
R2007 D15-L
R2008 E14-L
R2009 E14-L
R2010 D14
R2011 D15-L
R2012 D15
R2013 E13
R2014 D14
R2016 D13-L
R2019 D15
R2021 D15-L
R2022 D14
R2023 D15-L
R2024 D14
R2026 D13
R2027 D13-L
R2028 D13
R2029 D13
R2031 E13-L
R2032 D13
R2033 D13
R2034 E13
R2035 D13
R2036 E12
R2037 E12
R2038 D13
R2039 D12
R2041 D12
R2042 D12
R2043 D13
R2044 D13
R2045 D13
R2046 D12
R2047 D12
R2048 E12
R2049 E13
R2052 E13
R2053 D13
R2054 D13
R2056 D12
R2057 E12
R2061 E12
R2062 E12
R2063 E12
R2064 E12
R2065 D12
R2071 E12
R2072 E12
R2073 D12
R2074 D12
R2076 E12
R2077 D12
R2078 E12
R2079 D12
R2081 E12
R2082 D12
R2083 E12
R2084 D12
R2086 D12
R2087 D12
R2088 D12
R2092 G11
R2093 G11
R2094 H10
R2096 G11
R2101 H10
R2102 H10
R2103 H10
R2106 H10
R2112 H9
R2113 H9
R2114 H9
R2200 E11
R2201 E11
R2202 D11
R2203 D11
R2204 D11
R2205 D11
R2205 D11
R2207 D11
R2208 D11

R2209 D11
R2210 D11
R2211 E11
R2212 E11
R2213 E11
R2214 E11
R2215 D11
R2216 E11
R2217 E11
R2218 E11
R2218 D11
R2220 E11
R2222 E11
R2223 E11
R2224 E11
R2226 E11
R2227 E10
R2228 E10
R2229 E10
R2231 E10
R2301 E9
R2302 E9
R2303 E8
R2304 E8
R2307 D8
R2308 E10
R2309 E10
R2311 D8
R2313 D7
R2314 D7
R3001 C15
R3002 C15
R3003 C15
R3006 C15-L
R3007 C15-L
R3008 D14-L
R3009 D14-L
R3010 C14
R3011 C15-L
R3012 B15
R3013 C13
R3014 C14
R3016 C13-L
R3019 C15
R3021 C15-L
R3022 C14
R3023 C15-L
R3024 C14
R3026 C13
R3027 C13-L
R3028 B13
R3029 B13
R3031 C13-L
R3032 C13
R3033 C13
R3034 C13
R3035 C13
R3036 C12
R3037 C12
R3038 C13
R3039 B12
R3041 B12
R3042 C12
R3043 C13
R3044 C13
R3045 C13
R3046 C12
R3047 C12
R3048 D12
R3049 D13
R3052 C13
R3053 C13
R3054 C13
R3056 C12
R3057 D12
R3061 D12
R3062 C12
R3063 C12
R3064 C12
R3065 C12
R3071 C12
R3072 C12
R3073 C12
R3074 C12
R3076 C12
R3077 C12
R3078 C12
R3079 C12
R3081 D12
R3082 C12
R3083 C12
R3084 C12
R3086 B12
R3087 C12
R3088 C12
R3092 G11
R3093 G11
R3094 H9
R3096 G11
R3102 A10
R3103 A10
R3104 A10
R3104 A10
R3106 A10
R3112 A9
R3113 A9
R3114 A9
R3200 D11
R3201 D11
R3202 C11
R3203 C11
R3204 C11
R3205 C11
R3206 C11
R3207 C11
R3208 C11
R3209 C11
R3210 C11
R3211 D11
R3212 D11
R3213 C11
R3214 C11
R3215 C11
R3216 C11
R3217 C11
R3218 C11
R3220 D11
R3222 D11
R3223 D11
R3224 D11
R3226 D11
R3227 D11
R3228 C10
R3229 C10
R3231 D10
R3301 C9
R3302 C9
R3303 C8
R3304 C8
R3307 B8
R3308 D10
R3309 D10
R3311 C8
R3313 D7
R3314 D7
R4001 B15
R4002 B15
R4003 A15
R4006 A15-L
R4007 A15-L
R4008 B14-L
R4009 B14-L
R4010 A14
R4011 A15-L
R4012 A15
R4013 B13
R4014 A14
R4016 A13-L
R4019 A15
R4021 A15-L
R4022 A14
R4023 A15-L
R4024 A14
R4026 A13
R4027 A13-L
R4028 A13
R4029 A13
R4031 B13-L
R4031 B13-L
R4032 A13
R4033 A13
R4034 B13
R4036 B12
R4037 B12
R4038 A13
R4039 A12
R4041 A12
R4042 A12
R4043 A13
R4044 A13
R4045 A13
R4046 A12
R4047 A12
R4048 B12
R4049 B13
R4052 B13
R4053 A13
R4054 A13
R4056 A12
R4061 B12
R4062 B12
R4063 B12
R4064 B12
R4065 A12
R4071 B12
R4072 B12
R4073 A12
R4074 A12
R4076 B12
R4077 A12
R4078 B12
R4079 A12
R4081 B12
R4082 A12
R4083 B12
R4084 A12
R4086 A12
R4087 A12
R4088 A12
R4092 G10
R4093 G10
R4094 H10
R4096 G10
R4101 A10
R4102 A10
R4103 A10
R4106 A10
R4112 A9
R4113 A9
R4114 A9
R4200 B11
R4201 B11
R4202 A11
R4203 A11

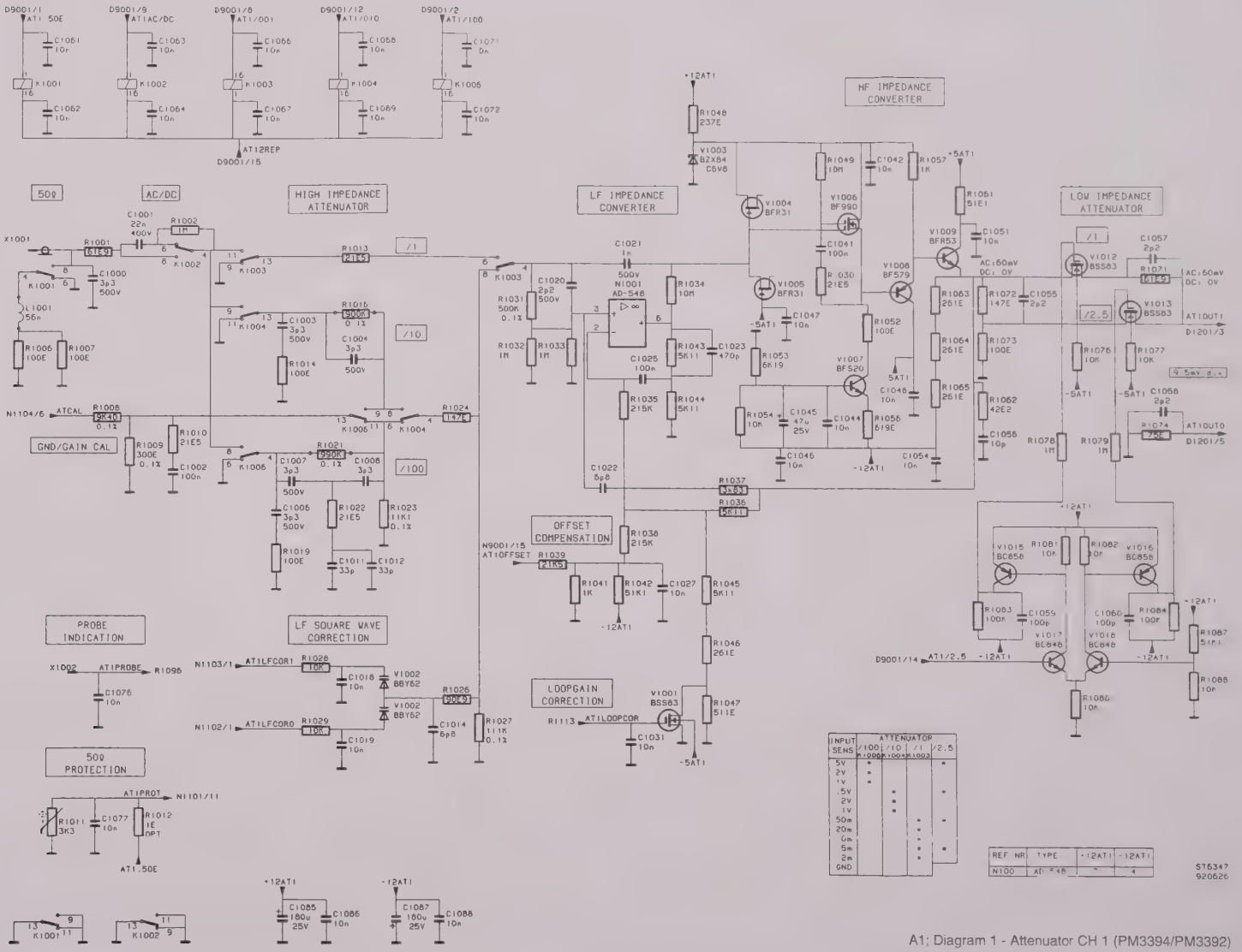
R4204 A11
R4205 A11
R4206 A11
R4207 A11
R4208 A11
R4209 A11
R4210 A11
R4211 B11
R4212 B11
R4213 B11
R4214 B11
R4215 A11
R4216 B11
R4217 B11
R4218 A11
R4220 B11
R4222 B11
R4223 B11
R4224 B11
R4226 B11
R4227 B10
R4228 B10
R4229 B10
R4231 B10
R4301 B9
R4302 B9
R4303 B8
R4304 B8
R4307 A8
R4308 B10
R4309 B10
R4311 A8
R4313 C7
R4314 C7
R5001 D6
R5002 E6
R5003 D6
R5004 D6
R5006 E6
R5007 D6
R5008 E6
R5009 D6
R5011 D6
R5012 D6
R5013 D6
R5014 D6
R5016 D6
R5017 D7
R5018 D6
R5019 D6
R5021 E6
R5024 C6
R5026 D6
R5027 C6
R5028 D6
R5029 C6
R5031 D6
R5032 D7
R5035 D6
R5036 C6
R5037 D6
R5041 C6
R5042 D6
R5043 D6
R5044 C6
R5045 D6
R5046 D6
R5047 D6
R5048 D6
R5049 D6
R5050 E7
R5051 D5
R5052 D5
R5053 C5
R5054 D6
R5055 D5
R5056 E6
R5057 E6
R5058 D6
R5060 D5
R5064 E6
R5065 E7
R5065 E7
R5066 D6
R5068 C7
R5069 C6
R5070 D6
R5071 C6
R5072 D6
R5076 E6
R5501 D10
R5502 D9
R5503 D9
R5504 C9
R5506 C9
R5507 D10
R5508 D10
R5509 D10
R5510 D9
R5511 D10
R5512 D10
R5513 D10
R5514 D10
R5516 D10
R5517 D10
R5518 D10
R5519 D9
R5521 D9
R5523 D9
R5524 D10
R5531 E8
R5533 D8
R5534 B8
R5536 E8
R5537 C8
R5538 D8
R5539 B8
R5541 D9
R5542 D9
R5543 D9
R5544 D9
R5546 C9
R5551 C10
R5552 C10
R5553 C10
R5554 C10
R5556 A8
R5557 C8
R5558 D8
R5559 F8
R5561 C10
R5562 D9
R5601 D9
R5602 C9
R5603 C9
R5603 C9
R5606 D9
R6001 C1
R6002 C1-L
R6003 B1-L
R6004 B1-L
R6005 B1-L
R6006 B1-L
R6007 B1-L
R6008 B1-L
R6009 B1
R6011 B2
R6012 B2
R6012 A6
R6013 C1-L
R6014 C1-L
R6015 C1
R6016 C1
R6017 C3
R6018 C3
R6019 B3
R6020 B3
R6021 B3
R6022 B3
R6023 B2
R6024 B2
R6025 B2
R6026 B2
R6027 C2
R6028 B3
R6029 C2
R6030 C2
R6031 B3
R6032 B3
R6033 B3
R6034 B3
R6035 C3
R6036 A3
R6037 B3
R6038 B2
R6041 C2
R6042 C2
R6043 C2
R6044 C2
R6045 C2
R6046 C2
R6047 C2
R6048 C2
R6049 C2
R6050 B2
R6051 B2
R6052 C2
R6053 C1
R6054 C2
R6061 C2
R6062 D2
R6063 D1
R6070 B3
R6071 A3
R6072 G5
R6073 A3
R6074 A3
R6093 G5
R6094 G5
R6101 D2
R6104 A3
R6502 B6
R6503 B6
R6508 B6
R6509 B6
R6511 B6
R6512 B6
R6521 B6
R6522 B6
R6523 B7
R6524 B7
R6526 B7
R6527 B7
R6528 B6
R6529 B6
R6531 B6
R6542 B6
R6543 B6
R6544 C5
R6546 A4
R6547 C5
R6548 A6
R6552 C6
R6554 C5

R6556 B6
R6558 C6
R6578 B5
R6579 B5
R6584 C5
R6586 C5
R6601 B6
R6602 B6
R6603 B5
R6616 B5
R6622 B4
R6624 A5
R6626 A5
R6627 B5
R6632 A4
R6633 B5
R6634 B4
R6636 A5
R6638 A5
R6641 A5
R6643 B5
R6646 B5
R6649 B5
R6661 B4
R6662 B5
R6684 C5
R6688 C5
R6689 C5
R6692 C5
R6694 C5
R6696 A4
R6706 B4
R6708 B4
R6709 B4
R6752 A6
R6753 A6
R6754 A6
R6756 A6
R6758 A6
R6762 A6
R6764 A6
R6769 A6
R6772 A5
R6774 A5
R6776 A5
R6782 A5
R6786 A5
R6788 A5
R6901 C6
R6911 A7
R6921 A7
R6931 A7
R6941 C6
R6951 B7
R6961 B7
R7001 G1
R7002 G1-L
R7003 G1-L
R7004 G1-L
R7005 G1-L
R7006 F1-L
R7007 F1-L
R7008 F1-L
R7009 E1
R7011 E1
R7012 E1
R7013 H1-L
R7014 H1-L
R7015 G1
R7016 G1
R7017 F2
R7018 G3
R7019 G3
R7021 F3
R7022 F2
R7023 G2
R7024 F2
R7025 F2
R7026 F2
R7027 G2
R7028 F3
R7029 G3
R7031 F3
R7032 G3
R7033 G3
R7034 G6
R7036 G6
R7041 G2
R7042 G2
R7043 H2
R7044 G2
R7045 G6
R7046 H2
R7047 H2
R7048 G2
R7049 G2
R7050 G2
R7050 G2
R7051 G2
R7052 F2
R7054 F3
R7056 F3
R7057 F4
R7057 F4
R7059 G3
R7064 D2-L
R7065 D2-L
R7066 D2-L
R7067 D2-L
R7077 G5
R7078 G5
R7082 F2
R7091 E2-L
R7092 F2-L
R7093 E2-L
R7094 E2-L
R7095 E2-L
R7096 E2-L
R7097 E2
R7099 G3
R7144 G2
R7150 G7
R7151 G7
R7152 G7
R7153 G7
R7154 G7
R7155 G6
R7156 G6
R7160 G7
R7180 G4
R7181 G4
R7204 C2
R7206 D2
R7207 E2
R7208 G2
R7209 D2
R7502 F6
R7503 F6
R7508 F6
R7509 F6
R7511 F6
R7512 F6
R7521 F6
R7522 F6
R7523 F6
R7523 F6
R7524 F6
R7526 F6
R7527 F6
R7528 F6
R7529 F6
R7531 F6
R7542 E5
R7543 E6
R7544 G5
R7546 F5
R7547 F5
R7548 E5
R7552 G6
R7554 F5
R7556 F5
R7558 F5
R7563 E5
R7571 F5
R7572 F5
R7576 F5
R7577 F5
R7578 F5
R7579 F5
R7584 F5
R7586 F5
R7681 E5
R7688 E6
R7689 E6
R7692 E5
R7693 F6
R7694 E6
R7696 F6
R7711 F7
R7712 F7
R7713 E5
R7716 D5
R7753 G6
R7754 G6
R7809 G4
R7901 G7
R7911 G7
R7921 F7
R7931 F7
R7941 E7
R7951 G6
R7952 G6
R7953 G6
R7954 F6
R7956 G7
R7957 F7
R7958 F7
R7961 F7
R8001 D3
R8002 D3
R8003 D3
R8004 D3
R8005 E3
R8006 D2
R8007 D3
R8008 D2
R8009 E3
R8010 E3
R8011 E3
R8012 E3
R8013 E3
R8014 E3
R8015 D2
R8016 D2
R8017 F4
R8018 E4
R8019 E3
R8020 E3
R8021 E3
R8022 E3
R8023 E4
R8024 E3
R8025 D4
R8026 B4

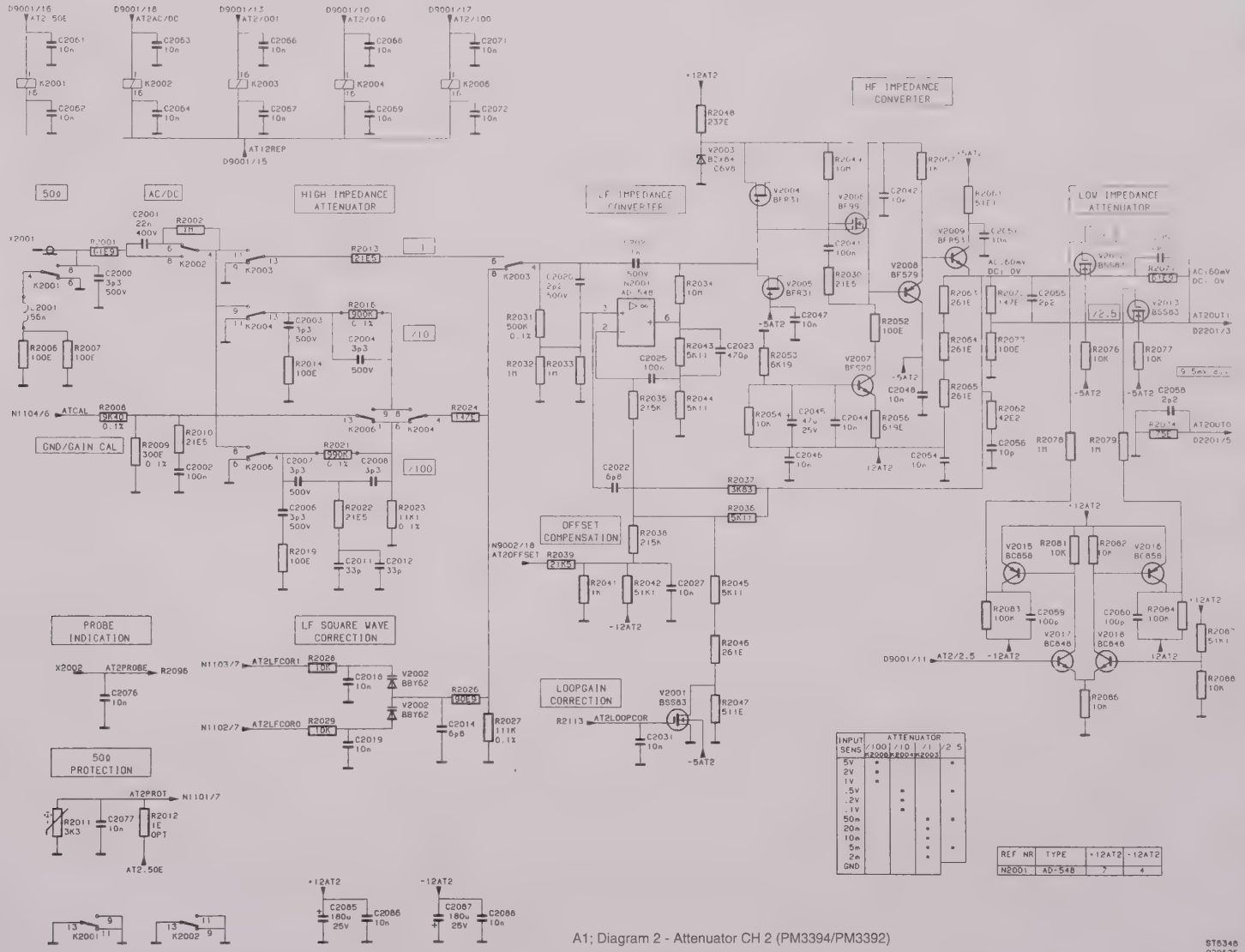
R8027 E3
R8028 D4
R8029 C4
R8030 F4
R8031 C4
R8033 C3
R8034 C3
R8035 C3
R8037 B3
R8038 B3
R8040 E4
R8041 F3
R8042 C3
R8043 C3
R8044 D4
R8045 D4
R8046 D4
R8047 D4
R8048 D4
R8049 E1
R8050 D4
R8051 D4
R8052 D4
R8053 F3
R8054 C3
R8055 C4
R8056 E4
R8057 E4
R8058 E4
R8059 E4
R8060 E4
R8061 F4
R8062 F4
R8063 F4
R8064 E4
R8065 E4
R8066 D3
R8067 D3
R8068 F4
R8069 E3
R8071 A4
R8073 B4
R8074 E4
R8075 E4
R8076 D4
R8077 C4
R8078 E4
R8079 D4
R8080 C4
R8081 D4
R8082 D4
R8084 C2
R8085 C2
R8086 D4
R8087 D4
R8088 E4
R8089 E4
R8090 D3
R8091 D3
R8092 C4
R8093 C4
R8094 C4
R8095 E3
R8096 E3
R8097 E4
R8098 E4
R8099 E4
R8100 F4
R8102 E1
R8103 D2
R8104 E1
R8105 C4
R8130 C3
R8131 C4
R8132 B3
R8133 D3
R8134 F4
R8135 F4
R8136 F4
R8200 E4
R8403 A1
R8404 A1
R8405 H5
R8410 B3
R8411 A3
V1001 F12
V1002 F13
V1003 G12
V1004 F13
V1005 F13
V1006 F13
V1007 F12
V1008 F12
V1009 F12
V1012 F12
V1013 F12
V1015 G12
V1016 F12
V1018 F12
V1201 F10
V1202 F10
V1206 G11
V1207 G11
V1208 G11
V1209 F10
V1251 G9
V1252 F10
V1301 E8
V1302 E8
V1304 G8
V1306 G8
V1307 G8
V1308 F8
V1313 F8
V2001 D12
V2002 D13
V2003 E12
V2004 E13
V2005 E13
V2006 E13
V2008 E12
V2009 E12
V2012 E12
V2013 E12
V2015 E12
V2016 D12
V2017 D12
V2018 D12
V2201 E10
V2202 E10
V2206 E11
V2207 E11
V2208 E11
V2209 E10
V2301 D8
V2302 D8
V2303 D8
V2304 E8
V2306 E8
V2307 E8
V3001 C12
V3002 C13
V3003 D12
V3004 C13
V3005 C13
V3006 C13
V3009 C12
V3012 C12
V3013 C12
V3015 D12
V3016 C12
V3017 B12
V3201 C10
V3202 C10
V3206 D11
V3207 D11
V3208 D11
V3209 C10
V3301 C8
V3302 B8
V3303 C8
V3304 C8
V3306 C8
V3307 C8
V4001 A12
V4002 A13
V4003 B12
V4004 B13
V4005 B13
V4006 B13
V4009 B12
V4012 B12
V4013 B12
V4015 B12
V4016 A12
V4017 A12
V4018 A12
V4201 B10
V4202 B10
V4206 B11
V4207 B11
V4208 B11
V4209 B10
V4301 A8
V4302 A8
V4303 A8
V4304 B8
V4306 B8
V4307 B8
V5001 D7
V5002 D7
V5003 D6
V5004 D6
V5006 D6
V5007 D6
V5008 D6
V5009 D6
V5011 D5
V5012 C6
V5013 D6
V5014 D5
V5016 C6
V5017 C6
V5018 D6
V5501 D10
V5502 D10
V5503 C9
V5504 D10
V5506 D9
V5601 D9
V6001 B1
V6002 C3
V6003 C1
V6004 C1
V6005 B2
V6006 B2
V6007 B2
V6008 C3
V6012 C2
V6013 C2-L
V6014 C2-L
V6016 B2
V6017 B2
V6018 C1

V6019 B2
V6022 C2
V6041 B3
V6042 B3
V6044 C4
V6062 D2
V6101 A2
V6506 B6
V6507 B6
V6532 B6
V6553 C6
V6573 C5
V6574 C5
V6593 C6
V6604 A5
V6606 B5
V6628 A4
V6631 A4
V6637 A4
V6667 B4
V6668 B5
V6686 B5
V6687 B5
V6691 C5
V6754 A6
V6757 A6
V6759 A6
V6761 A6
V6763 A6
V6764 A4
V6768 A6
V6784 A5
V7001 F2
V7003 G2
V7004 G2
V7005 G2
V7006 F2
V7007 F2
V7012 G2
V7016 G2
V7017 G2
V7018 F2
V7019 H2-L
V7020 G2-L
V7031 G6
V7032 G6
V7075 D2
V7091 E2
V7093 C2
V7094 F2
V7150 G7
V7151 G7
V7152 G6
V7506 F6
V7507 F6
V7532 F6
V7553 G6
V7573 F5
V7574 F5
V7686 F6
V7687 F6
V7691 E6
V7714 D5
V7801 G5
V7802 G5
V7803 G5
V7804 G5
V7805 G5
V7806 G5
V7807 G5
V7808 G5
V8002 E3
V8003 C4
V8004 E3
V8006 E3
V8007 F4
V8008 F3
V8009 F4
V8011 E3
V8012 E3
V8013 C3
V8014 C3
V8015 E2
V8018 B4
V8019 B4
V8023 D4
V8024 D4
V8028 D4
V8029 E4
V8031 D4
V8040 E3
V8041 D4
V8042 C2
V8043 C2
V8044 F4
V8061 E4
V8062 E4
V8063 E4
V8065 E4
V8066 F4
V8067 D3
V8068 D3
V8101 E4
X5001 D6-L
X9001 H8-L
X9002 H4-L

5.1.5 Circuit diagrams

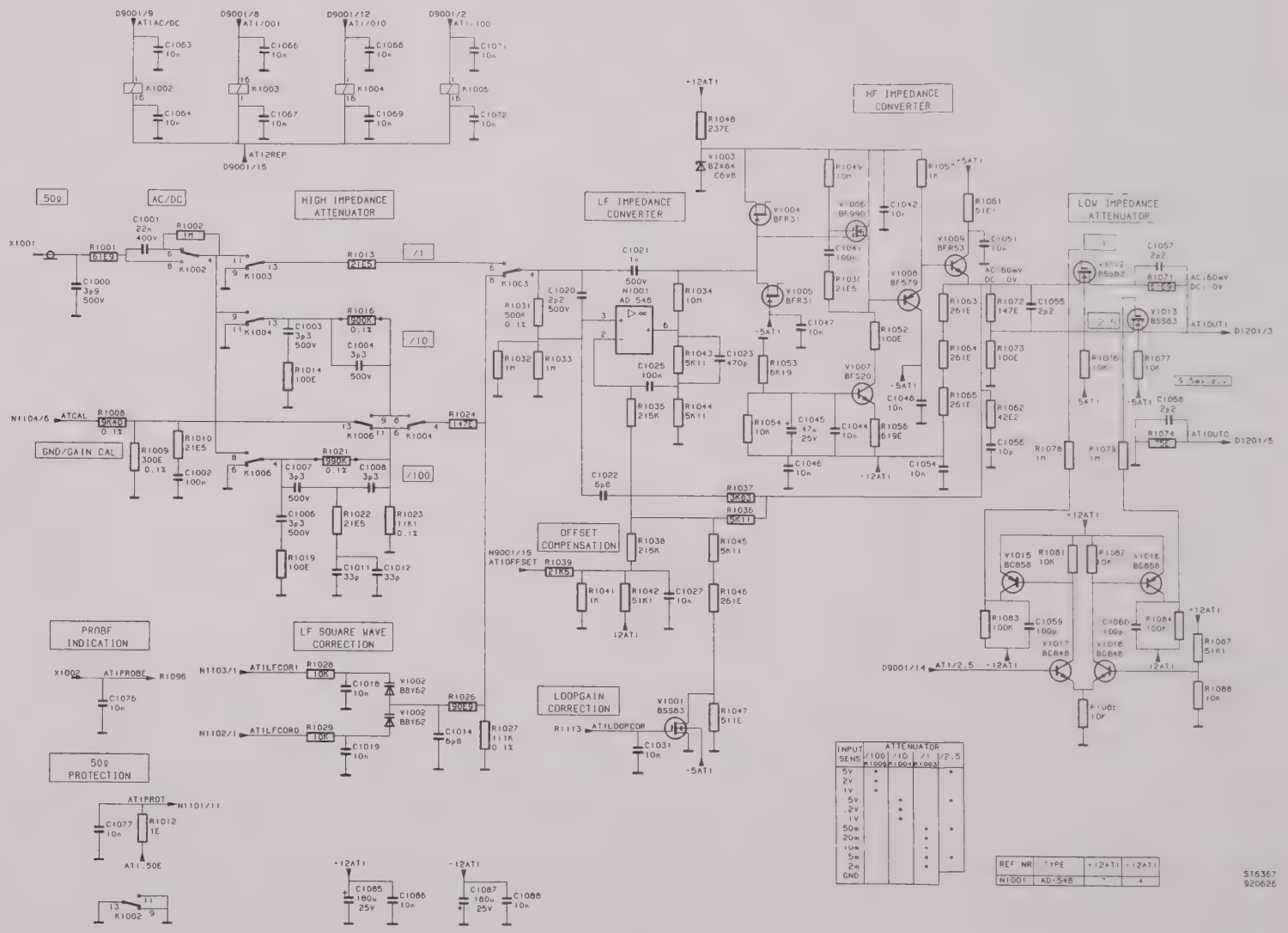


A1; Diagram 1 - Attenuator CH 1 (PM3394/PM3392)

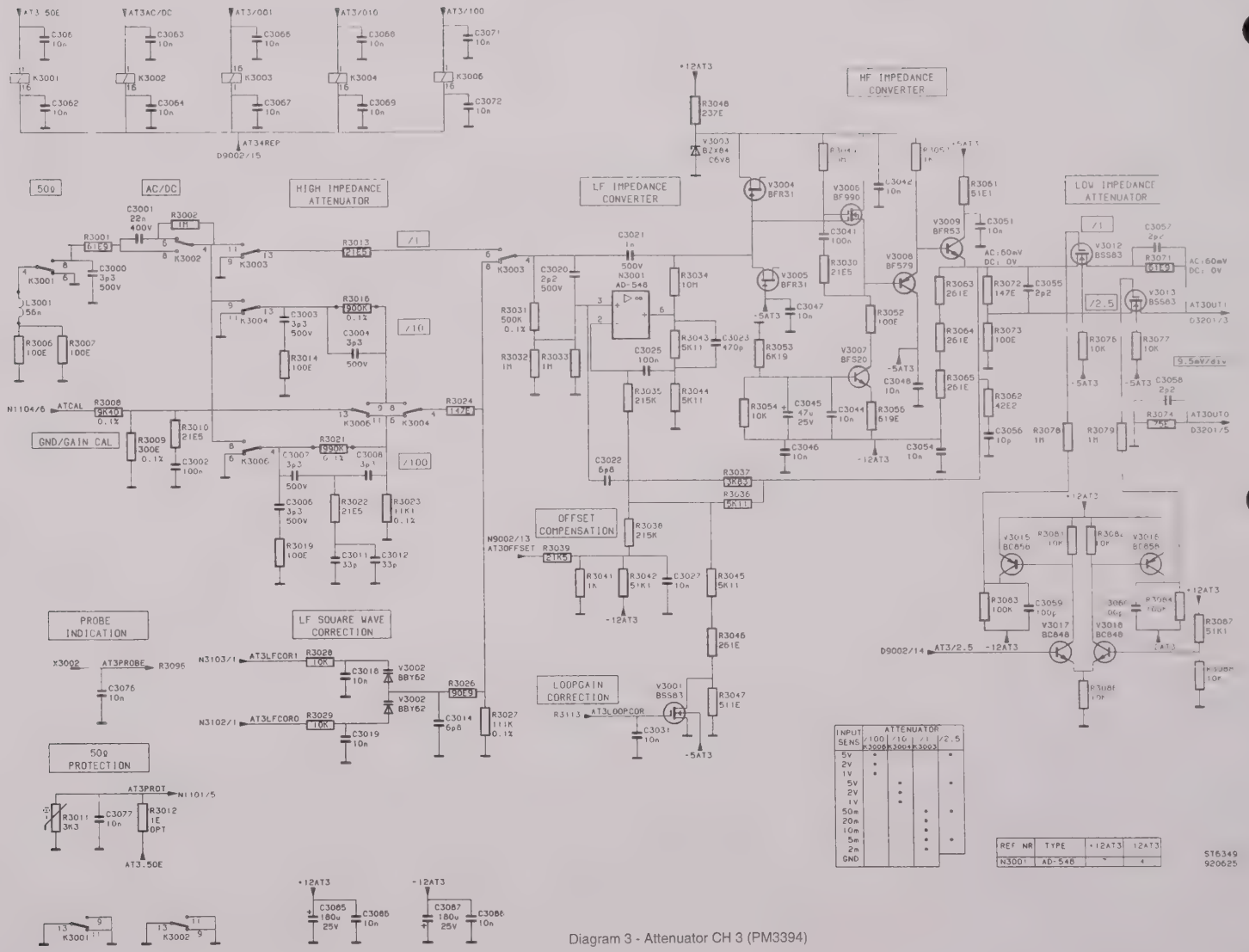


A1; Diagram 2 - Attenuator CH 2 (PM3394/PM3392)

ST5348
920625



A1; Diagram 2a - Attenuator CH 1 (PM3384/PM3382)


50Ω
AC/DC
HIGH IMPEDANCE ATTENUATOR
LF IMPEDANCE CONVERTER
HF IMPEDANCE CONVERTER
LOW IMPEDANCE ATTENUATOR
GND/GAIN CAL
OFFSET COMPENSATION
LF SQUARE WAVE CORRECTION
LOOPGAIN CORRECTION
PROBE INDICATION
50Ω PROTECTION
/1
/10
/100
/2.5
+12AT3
-12AT3
-5AT3
AT3 50E
AT3AC/DC
AT3/001
AT3/010
AT3/100
AT34REP
D9002/15
ATCAL
AT3PROBE
AT3PROT
AT3.50E
AT3LFCOR1
AT3LFCOR0
AT3LOOPCOR
AT3OFFSET
AT3OUT1
AT3OUT0
D3201/3
D3201/5
D9002/14
AT3/2.5
9.5mV/div
AC:60mV DC: 0V
INPUT SENS
ATTENUATOR
REF NR
TYPE
N3001
AD-546
ST6349
920625
Diagram 3 - Attenuator CH 3 (PM3394)

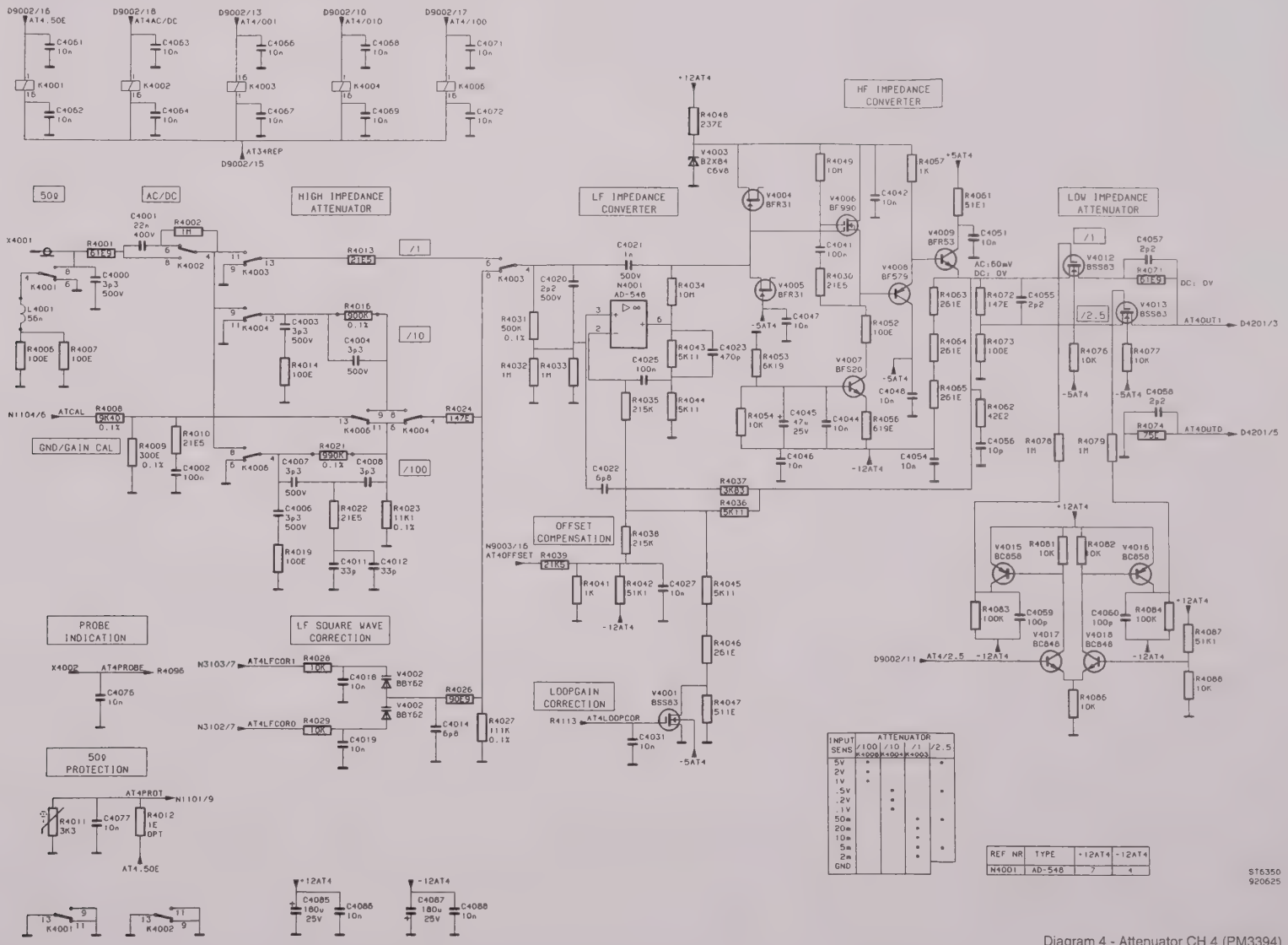


Diagram 4 - Attenuator CH 4 (PM3394)

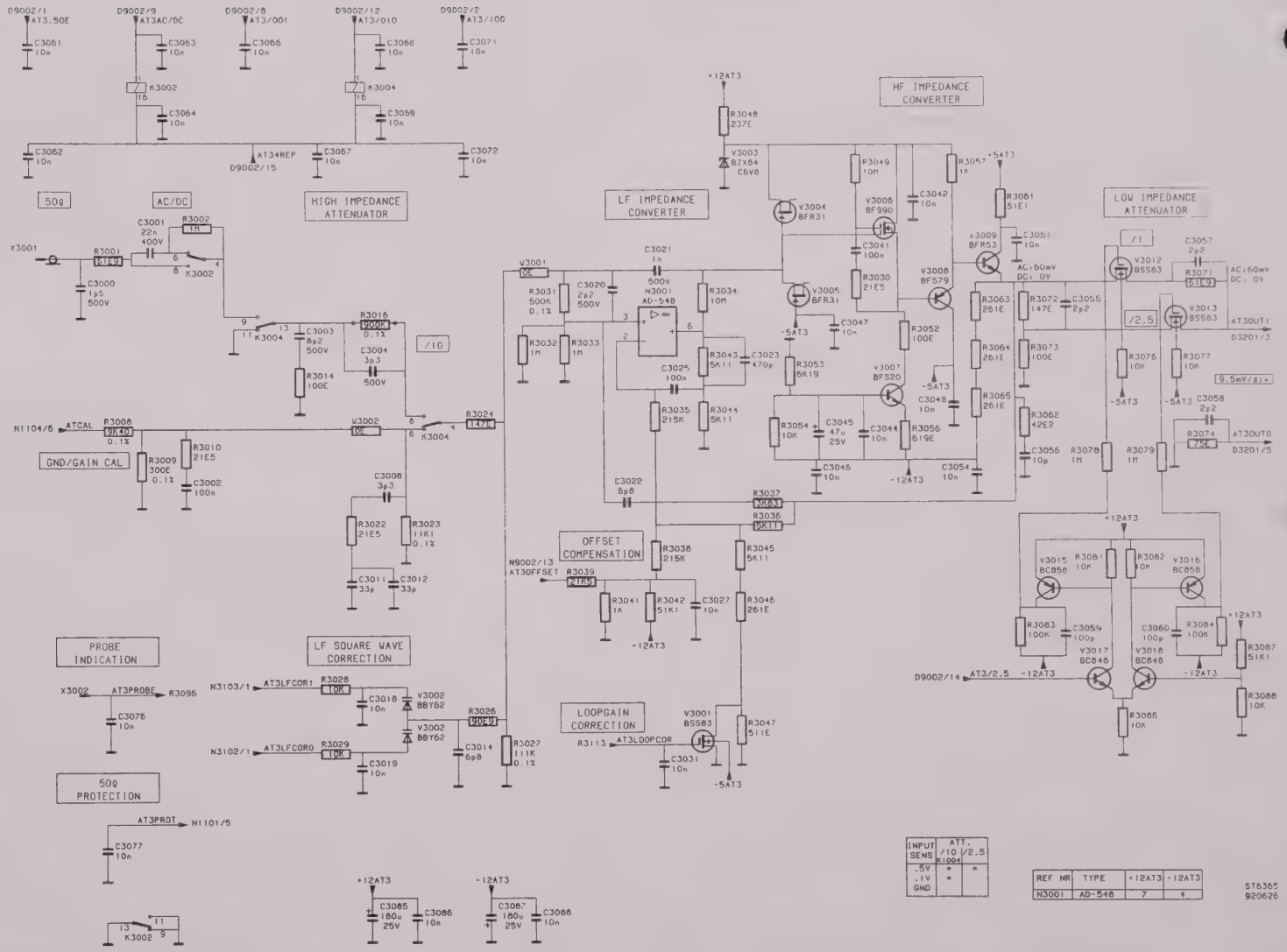
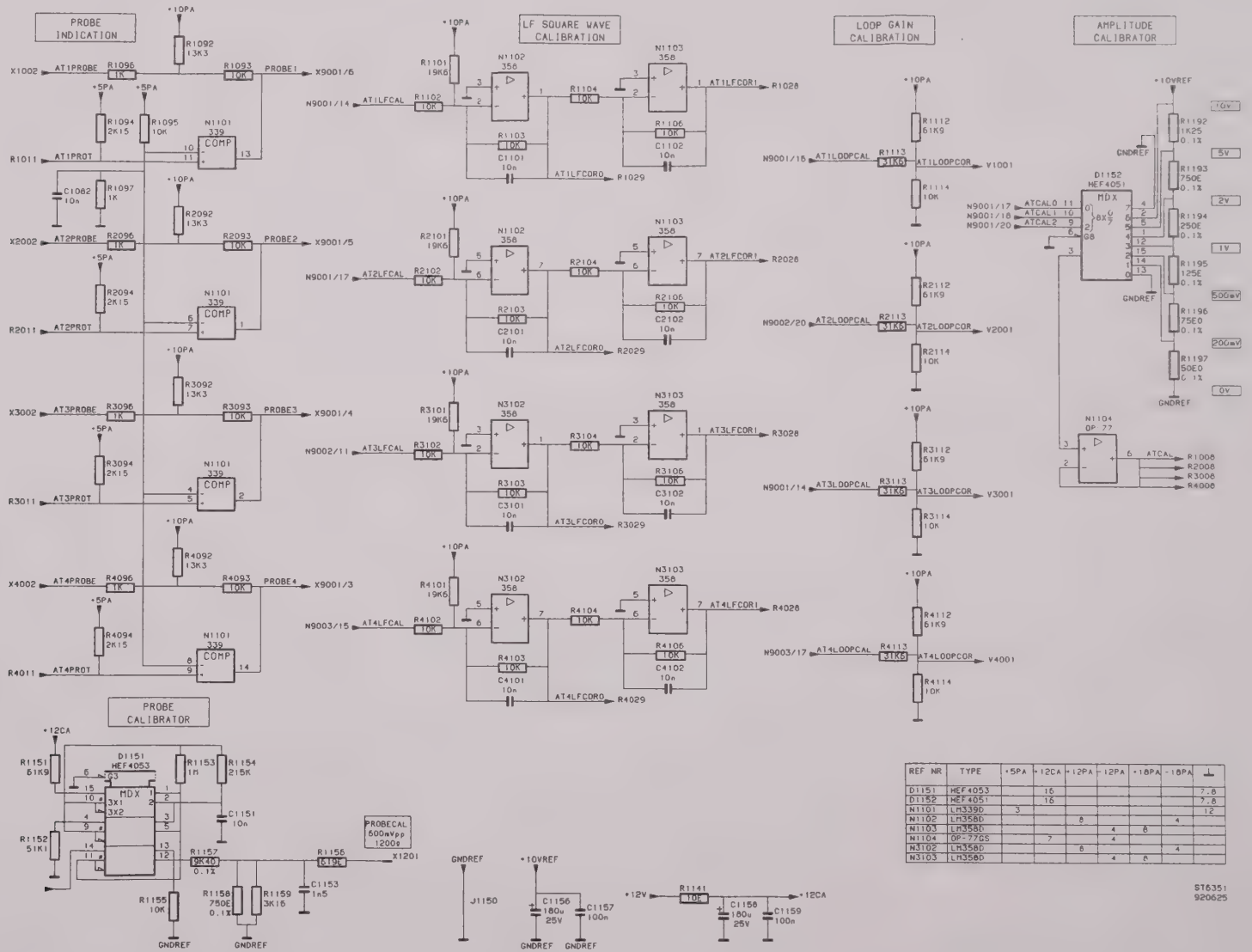


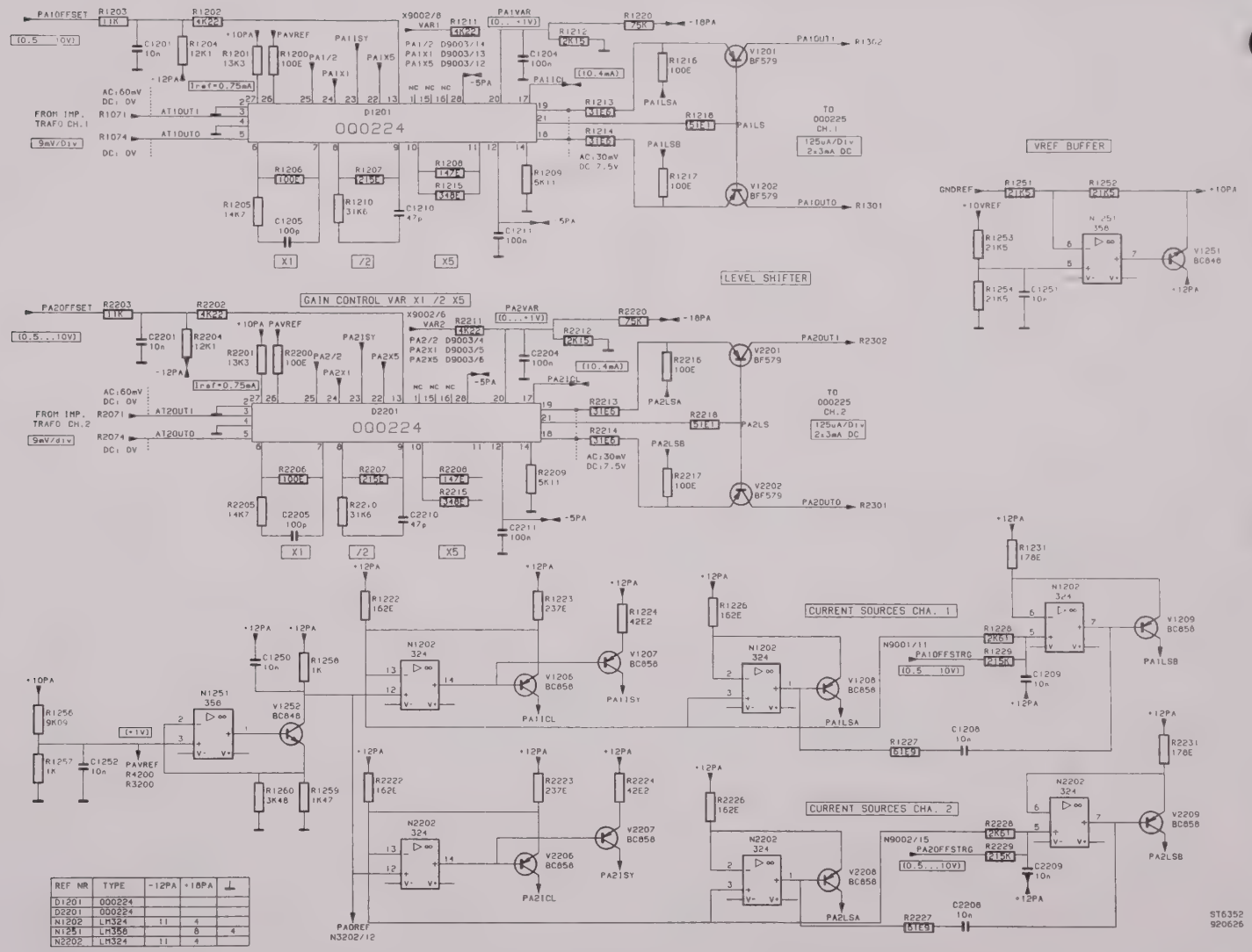
Diagram 4a - Attenuator CH3 (PM3392/PM3382)



REF NR	TYPE	+5PA	+12CA	+12PA	-12PA	+18PA	-18PA	⊥
D1151	HEF4053		16					7,8
D1152	HEF4051		16					7,8
N1101	LM339D	3						12
N1102	LM358D			8			4	
N1103	LM358D				4	8		
N1104	OP-77GS		7		4			
N3102	LM358D			8			4	
N3103	LM358D				4	8		

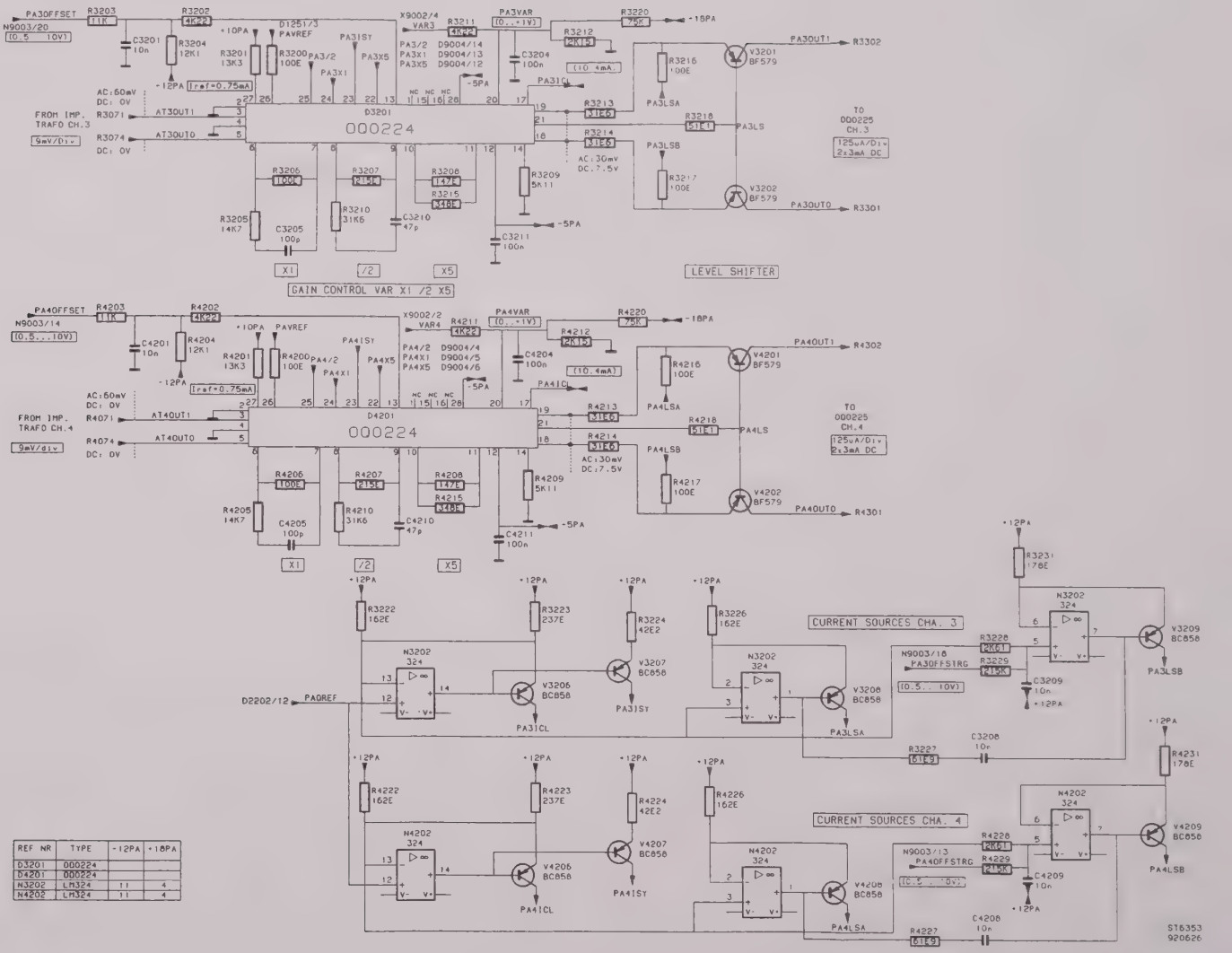
ST6351
920625

Diagram 5 - Attenuator control + CAL generator



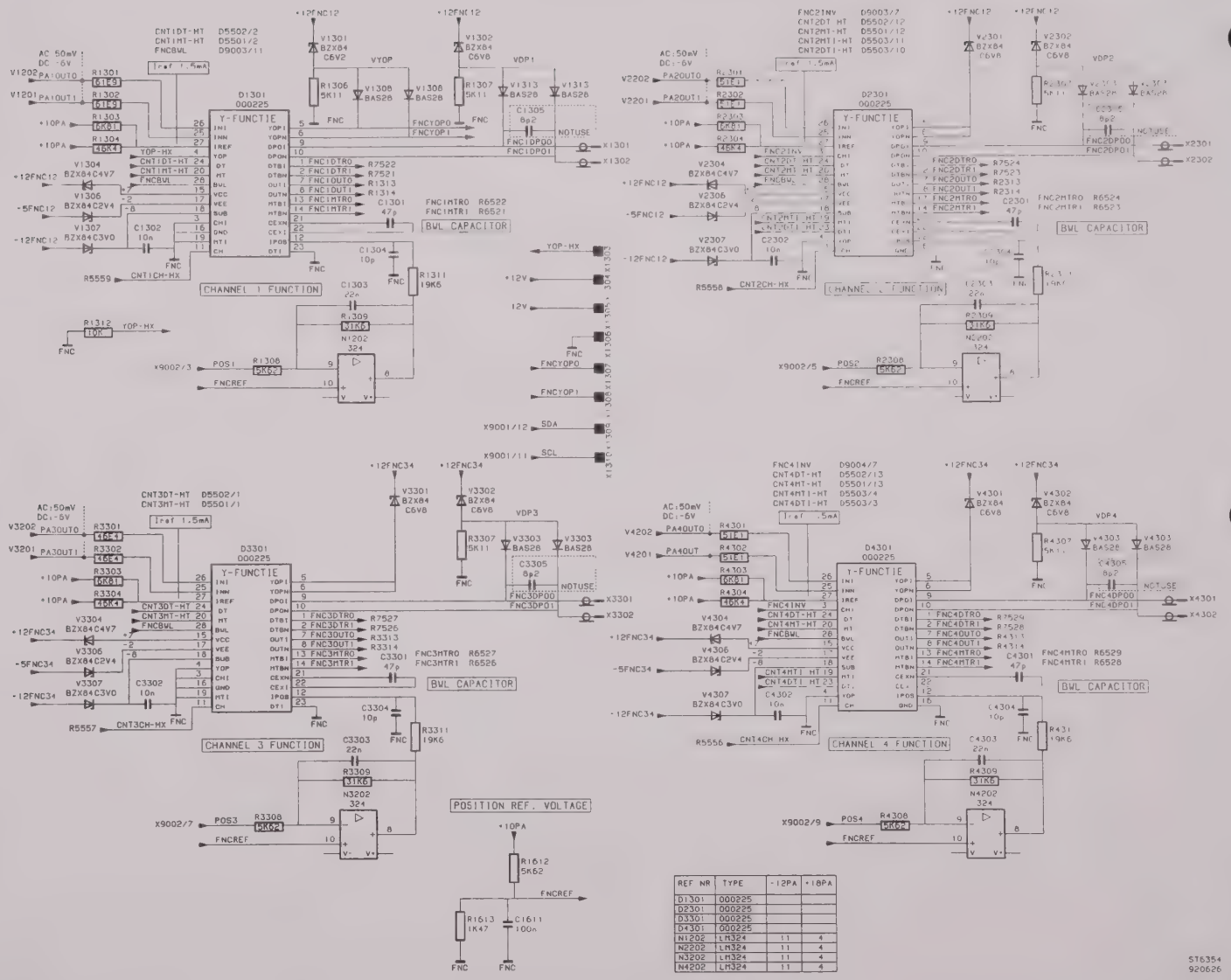
REF NR	TYPE	-12PA	+18PA	⊥
D1201	000224			
D2201	000224			
N1202	LM324	11	4	
N1251	LM356		8	4
N2202	LM324	11	4	

Diagram 6 - Preamplifier CH 1 and CH 2



REF NR	TYPE	-12PA	+18PA
D3201	000224		
D4201	000224		
N3202	LM324	11	4
N4202	LM324	11	4

Diagram 7 - Preamplifier CH 3 and CH 4



REF NR	TYPE	-12PA	+18PA
D1301	000225		
D2301	000225		
D3301	000225		
D4301	000225		
N1202	LM324	11	4
N2202	LM324	11	4
N3202	LM324	11	4
N4202	LM324	11	4

ST6354
920626

Diagram 8 - Y-functions

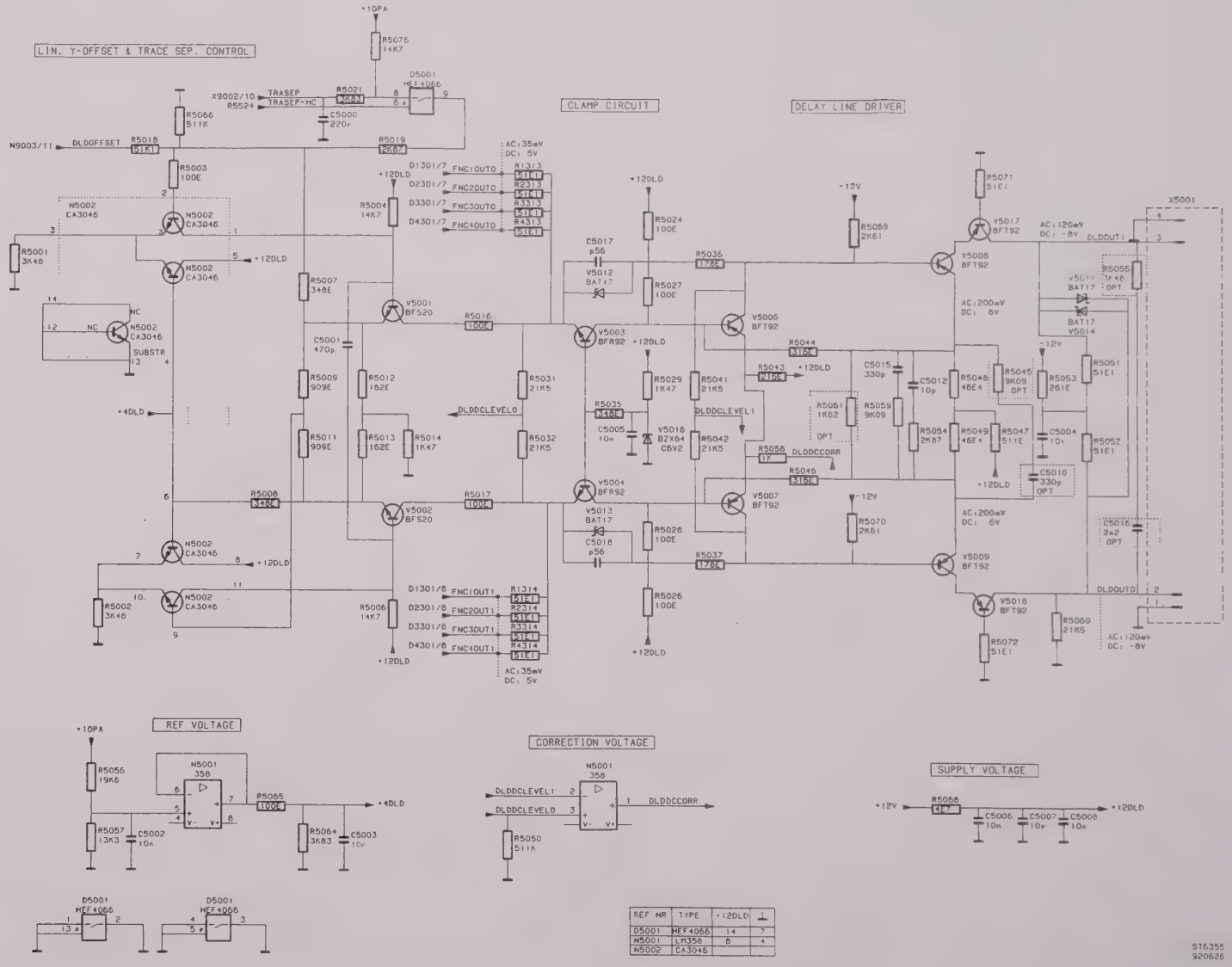
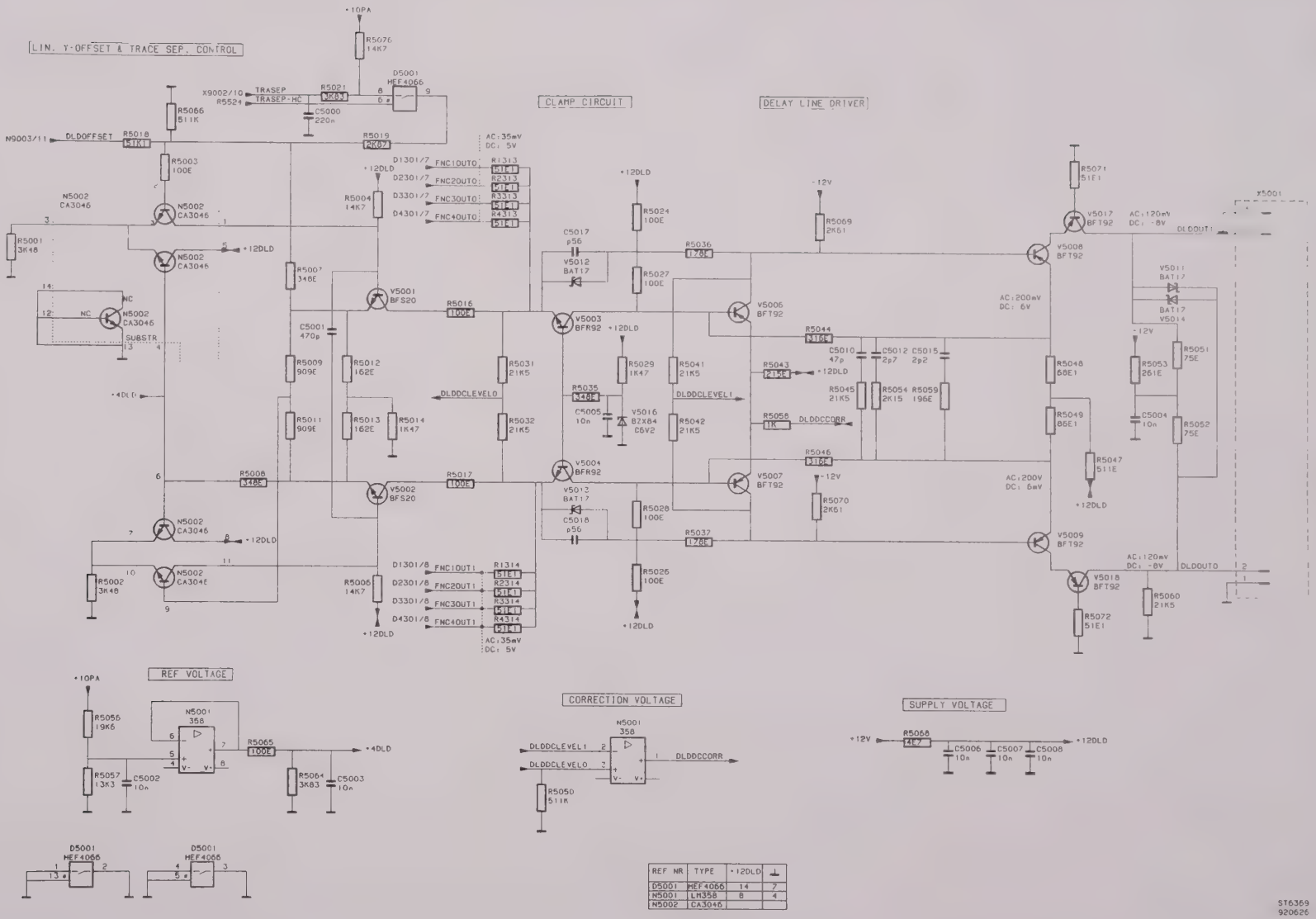


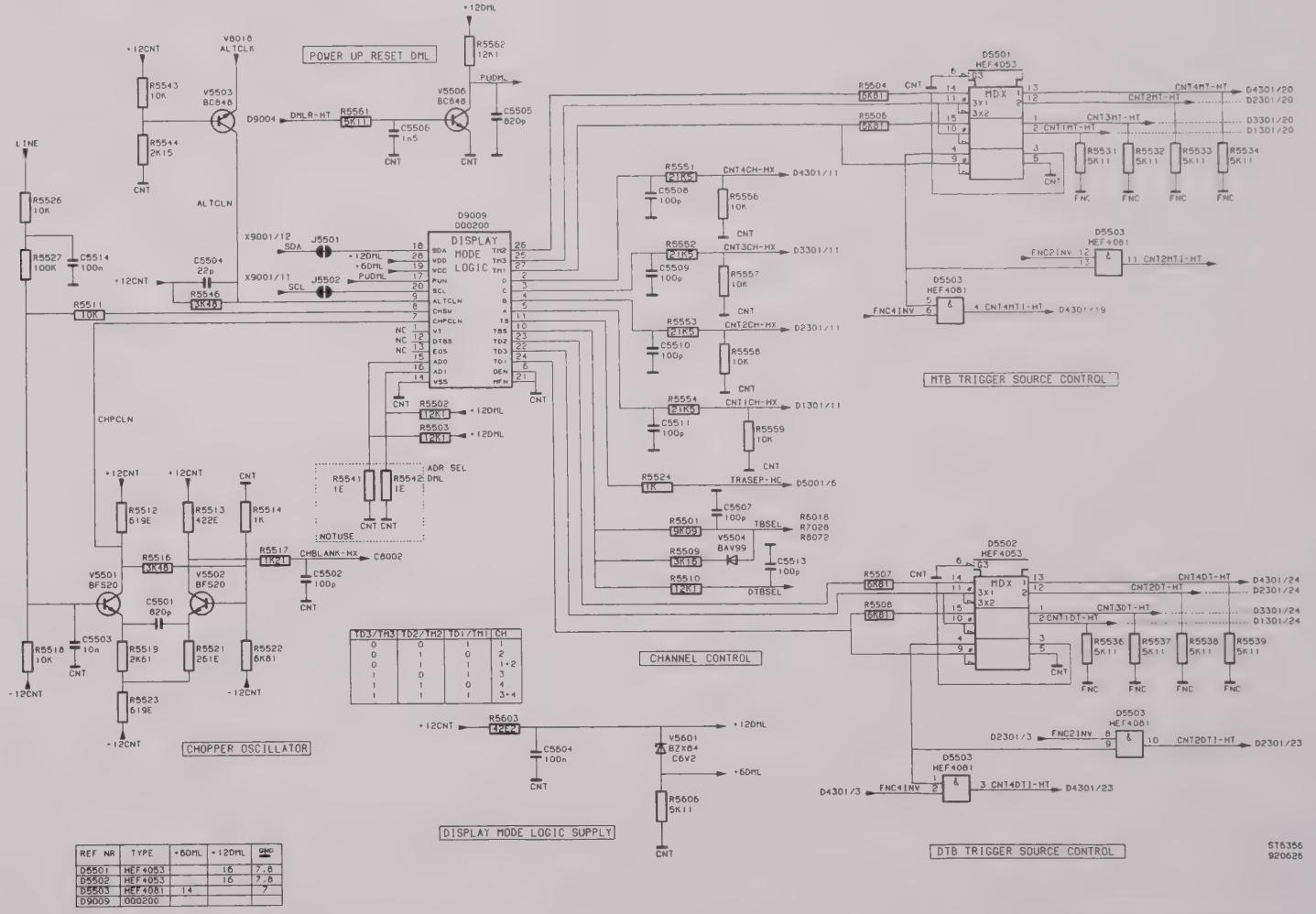
Diagram 9 - Delay line driver (PM3394/PM3392)



REF NR	TYPE	+12DLD	⏚
D5001	HEF4066	14	7
N5001	LM358	8	4
N5002	CA3046		

ST6369
920626

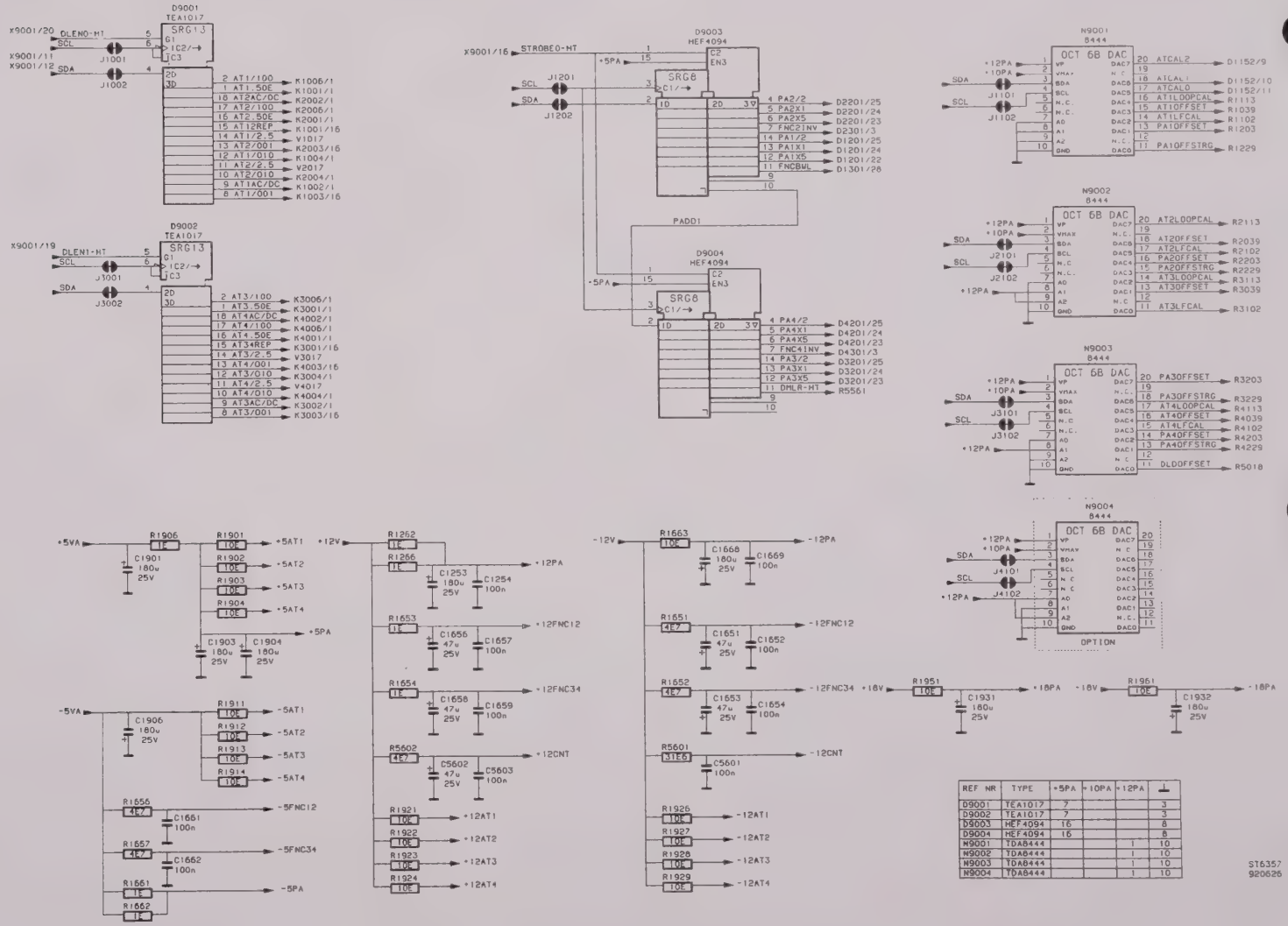
Diagram 9a - Delay line driver (PM3384/PM3382)



REF NR	TYPE	+6DML	+12DML	GND
D5501	HEF4053		16	7,8
D5502	HEF4053		16	7,8
D5503	HEF4081	14		7
D9009	000200			

ST6356
920626

Diagram 10 - Display and trigger control



REF NR	TYPE	+5PA	+10PA	+12PA	⊥
D9001	TEA1017	7			3
D9002	TEA1017	7			3
D9003	HEF4094	16			8
D9004	HEF4094	16			8
N9001	TDA8444			1	10
N9002	TDA8444			1	10
N9003	TDA8444			1	10
N9004	TDA8444			1	10

ST6357
920626

Diagram 11 - Control circuits

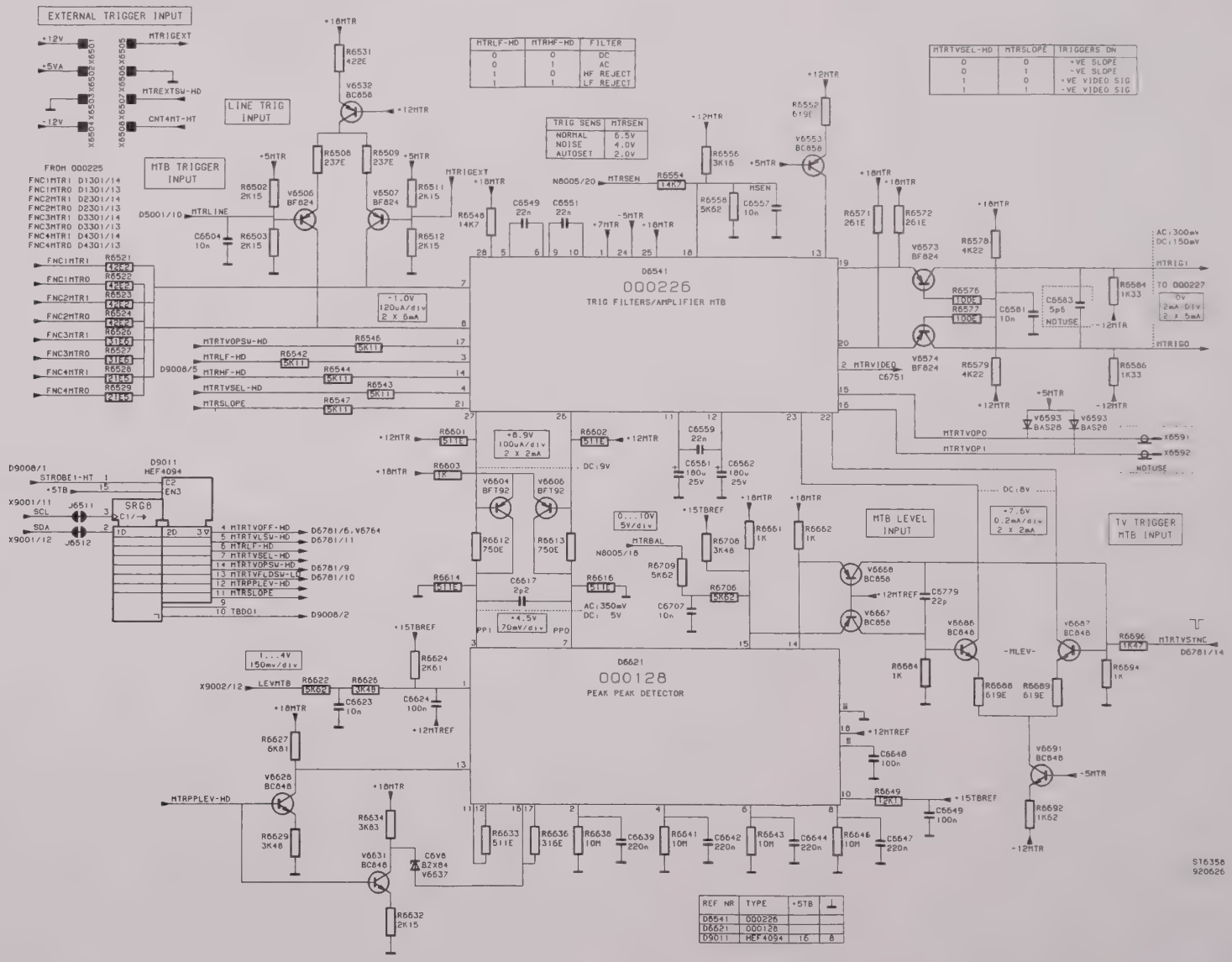
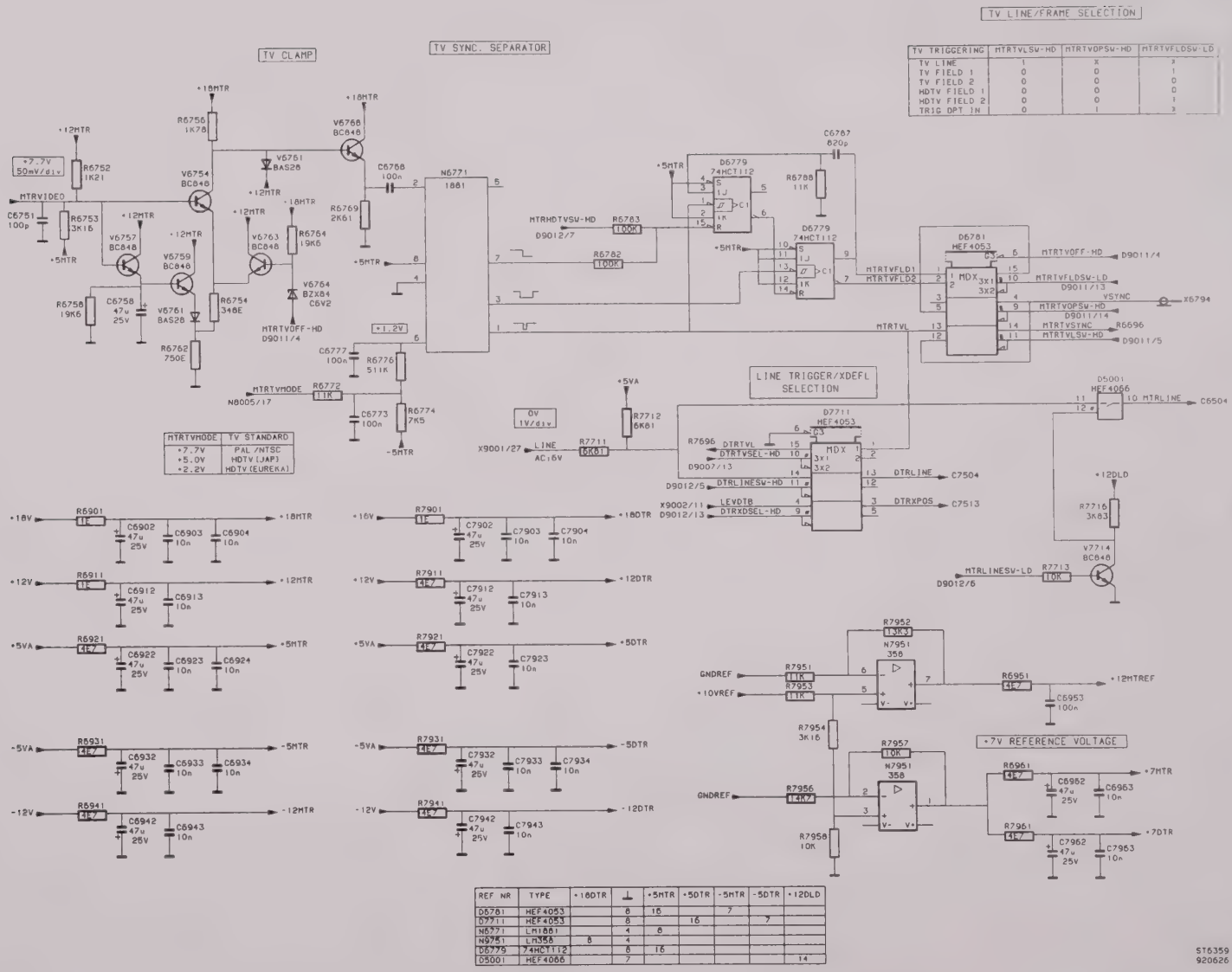


Diagram 12 - MTB trigger



TV TRIGGERING	MTRTVLSW-MD	MTRTVOPSW-MD	MTRTVFLDSW-LD
TV LINE	1	X	X
TV FIELD 1	0	0	1
TV FIELD 2	0	0	0
HDTV FIELD 1	0	0	0
HDTV FIELD 2	0	0	1
TRIG OPT IN	0	1	X

MTRTVMODE	TV STANDARD
+7.7V	PAL /NTSC
+5.0V	HDTV (JAP)
+2.2V	HDTV (EUREKA)

REF NR	TYPE	+18DTR	⊥	+5MTR	+5DTR	-5MTR	-5DTR	+12DLD
D6781	HEF4053		8	16		7		
D7711	HEF4053		8		16		7	
N6771	LM1881		4	8				
N6751	LM358	8	4					
D6779	74HCT112		8	16				
D5001	HEF4066		7					14

ST6359
920626

Diagram 13 - TV/line trigger

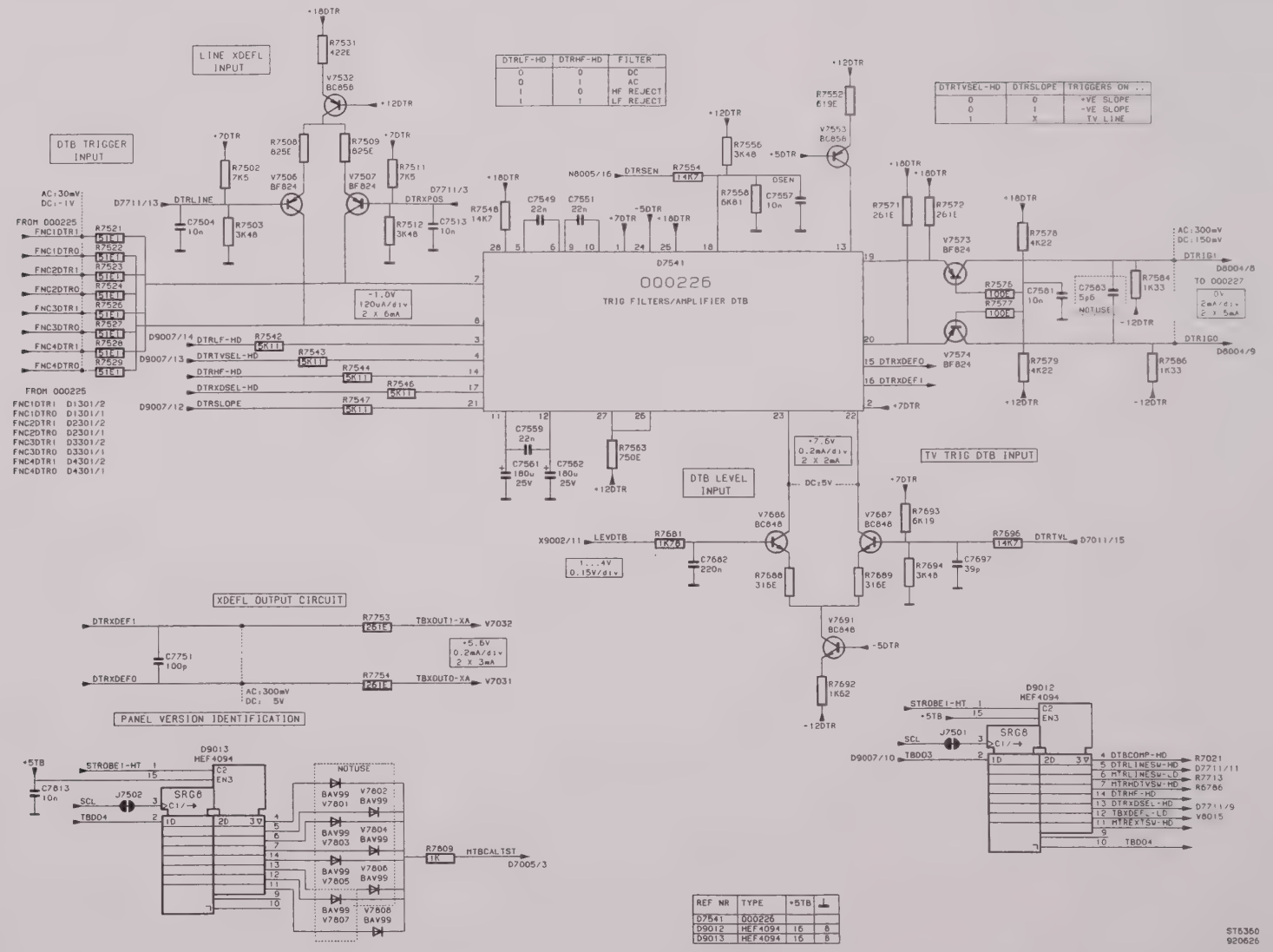


Diagram 14 - DTB trigger

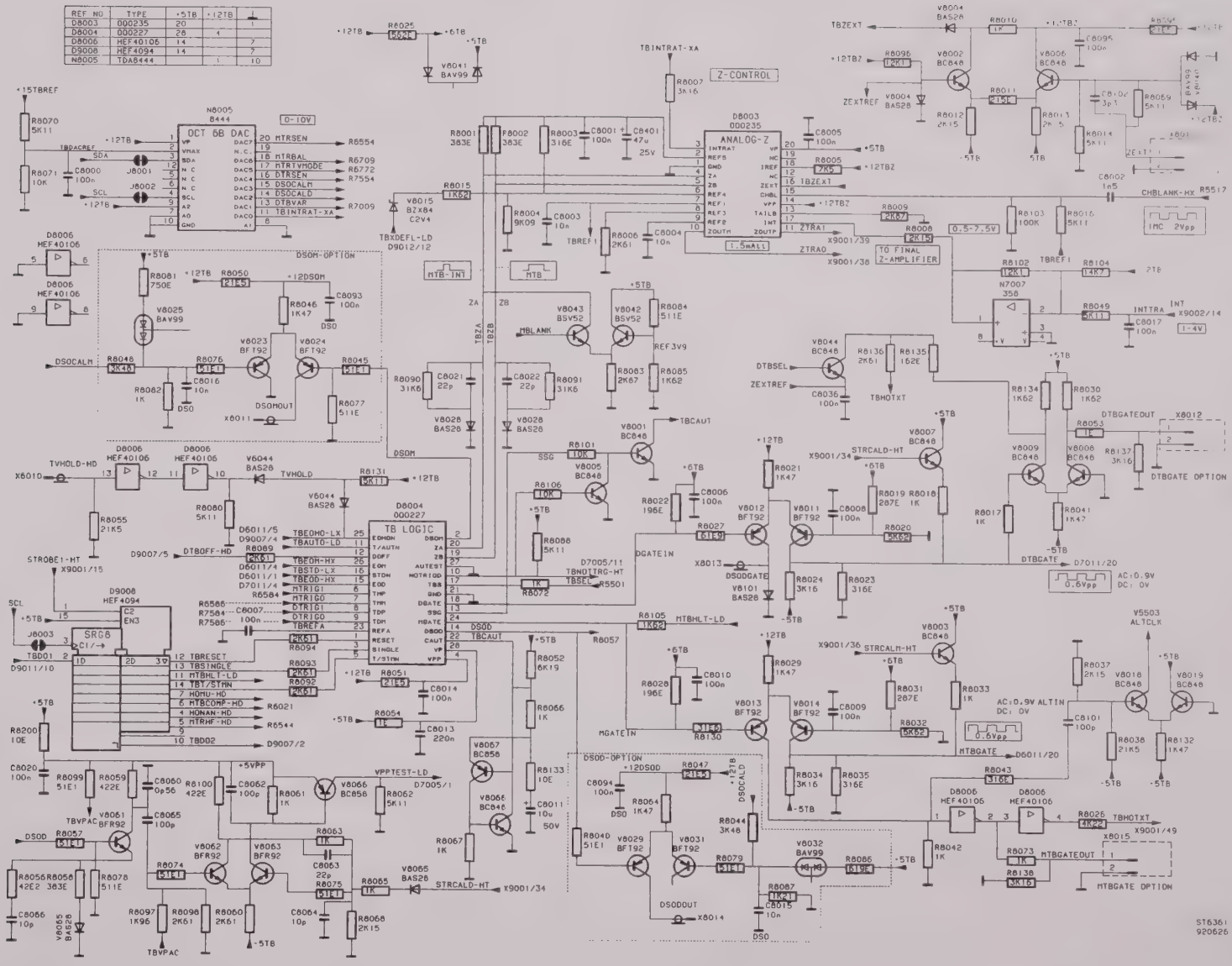


Diagram 15 - Time base logic

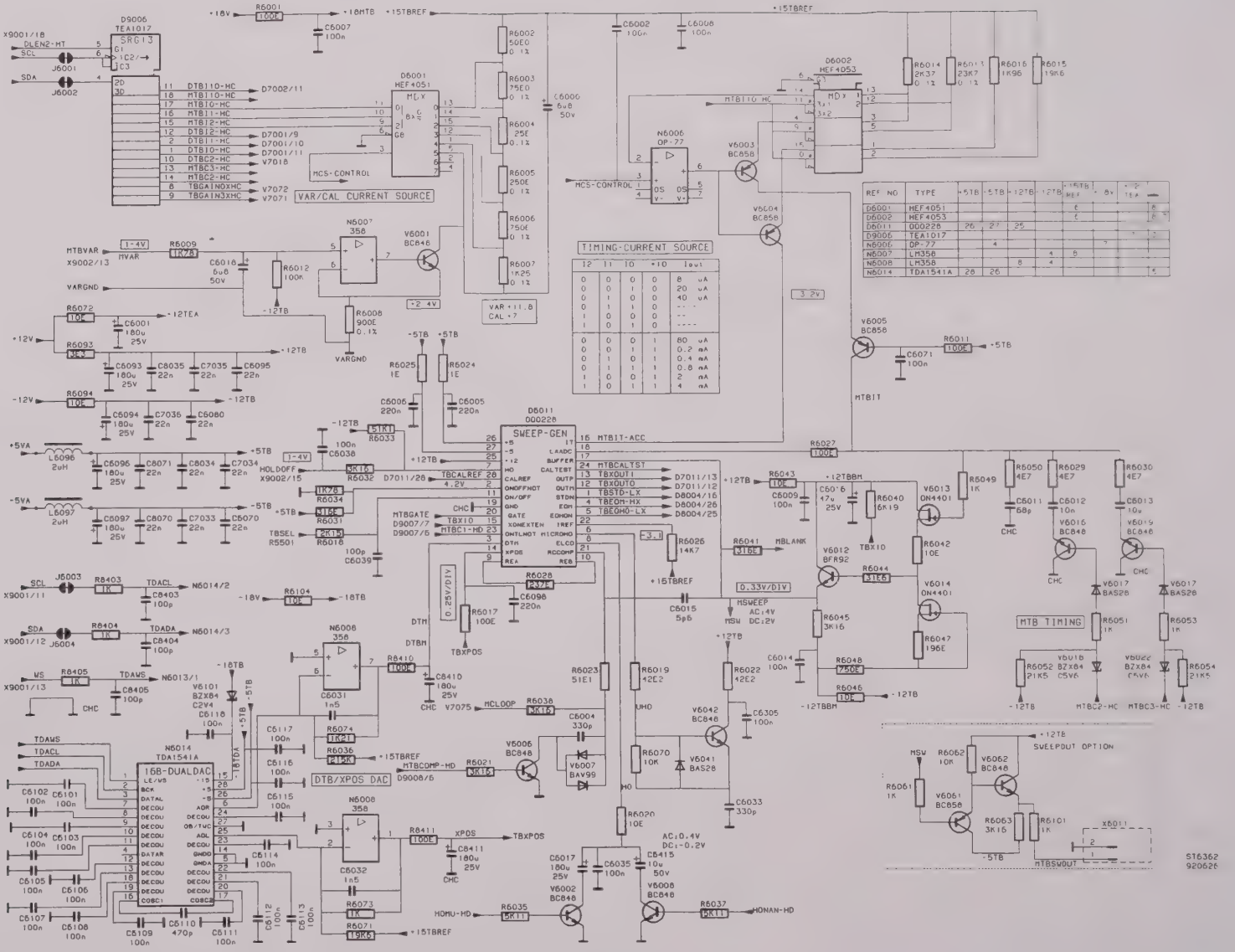


Diagram 16 - Main time base

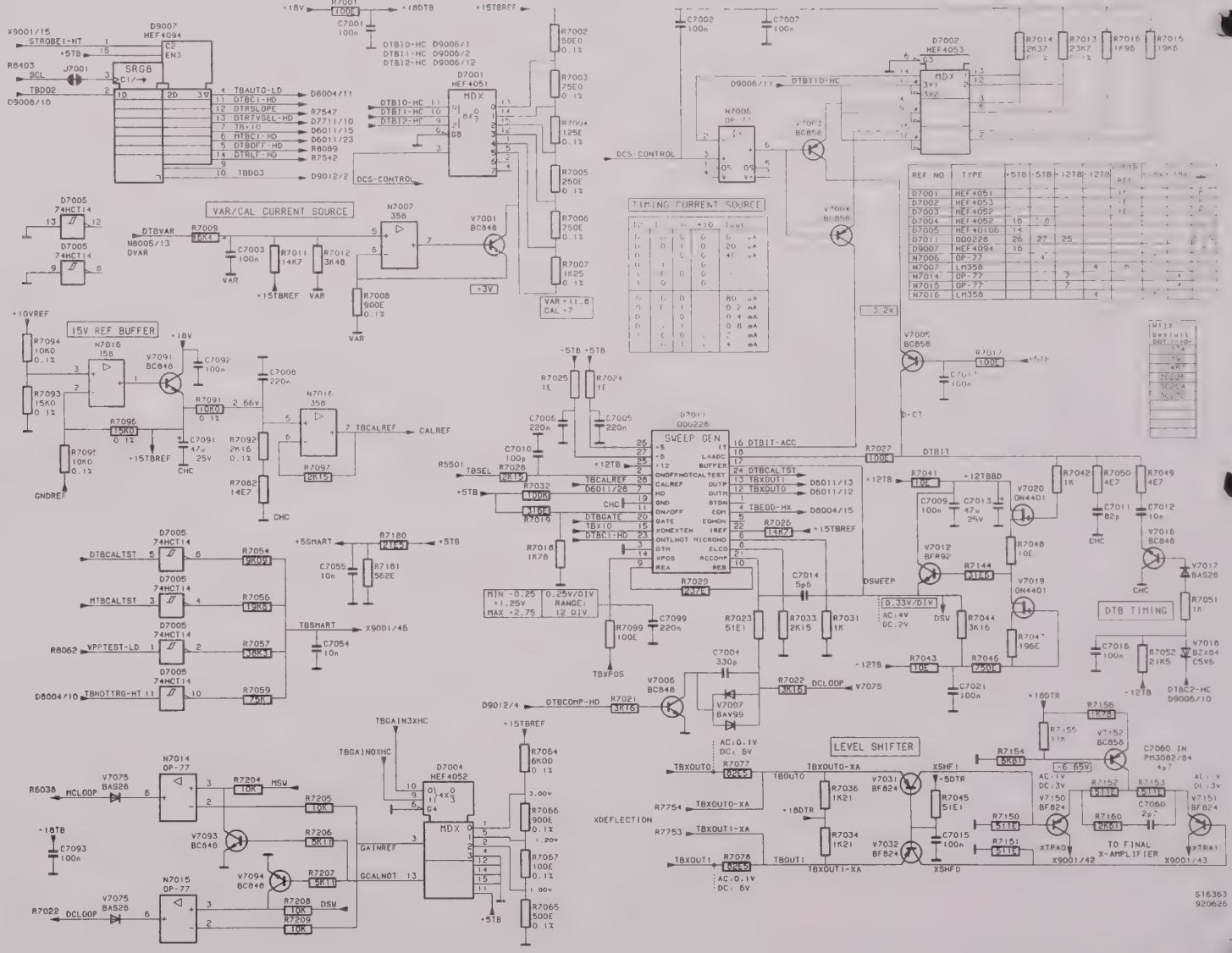


Diagram 17 - Delayed time base

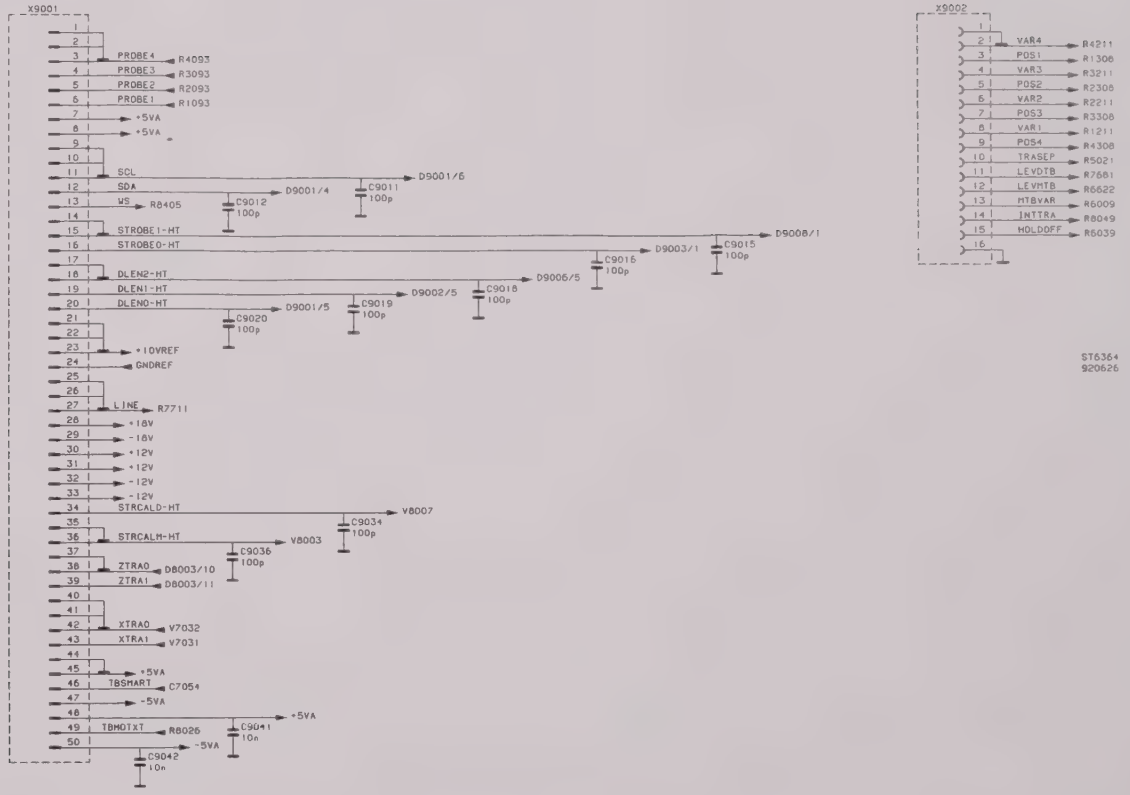


Diagram 18 - Connectors

5.1.6 Differences between typenumbers

The changes on unit A1 take place in the attenuators, Y-functions and delay line driver. This is done by change of component values and by removal of components.

The explanation of the differences is compared with the most extensive version of Signal unit A1. This version is used in model number PM3394 (200 MHz and 4 full-feature channels) and is described in the previous sections.

The diagrams after this text, are the diagrams that are changed according the descriptions below. The figure description gives the type number it is valid for.

PM3392.

This model has a bandwidth of 200 MHz; the channels 3 and 4 however only have 2 input sensitivities (0.1 and 0.5 V/div) and no 50Ω input impedance. This is realized by:

- The removal of L3001, K3001, K3003, K3006, R3006, R3007, R3011, R3021, C3006, C3007 in CH3.
- C3000 is changed into 1 pF (5322 122 32773) in CH3.
- C3003 is changed into 8.2 pF (4822 122 31194) in CH3.
- The bridge wires W3001 and W3002 are added in CH3.
- The removal of L4001, K4001, K4003, K4006, R4006, R4007, R4011, R4021, C4006, C4007 in CH4.
- C4000 is changed into 1 pF (5322 122 32773) in CH4.
- C4003 is changed into 8.2 pF (4822 122 31194) in CH4.
- The bridge wires W4001 and W4002 are added in CH4.
- The bridge wire W4003 is added between 'AT4PROT' (N1109/9) and 'AT4.50E' in CH4.

PM3384

This model has a bandwidth of 100 MHz; there are 4 full-feature channels and no 50Ω input impedance. This realized by:

- The removal of L1001, K1001, C1061, C1062, R1011, R1006, R1007 in CH1.
- C1000 is changed into 3.9 pF (4822 122 31217) in CH1.
- R1012 (1Ω, 4822 051 10108) is added between 'AT1PROT' and 'AT1.50E' in CH1.
- The removal of L2001, K2001, C2061, C2062, R2011, R2006, R2007 in CH2.
- C2000 is changed into 3.9 pF (4822 122 31217) in CH2.
- The removal of L3001, K3001, C3061, C3062, R3011, R3006, R3007 in CH3.
- C3000 is changed into 3.9 pF (4822 122 31217) in CH3.
- The removal of L4001, K4001, C4061, C4062, R4011, R4006, R4007 in CH4.
- C4000 is changed into 3.9 pF (4822 122 31217) in CH4.
- R5043 is changed from 162 into 237 Ω (4822 116 82882).
- R5069 and R5070 are changed from 1.96 into 2.61 kΩ (4822 111 91821).
- C5010 is changed from 100 into 47 pF (5322 122 32452).
- R5045 is changed from 10 into 19.6 kΩ (5322 116 82901).
- C5015 is changed from 2.7 into 2.2 pF (5322 122 32774).
- R5059 is changed from 316 into 196Ω (4822 111 91817).
- R5048 and R5049 are changed from 46.4 into 68.1Ω.
- R5051 and R5052 are changed from 51.1 into 75Ω (4822 111 91937).
- R5055 and C5016 are removed.

A series circuit C5012 (2.7 pF, 5322 122 31873) and R5054 (1.47 kΩ, 5322 111 91902) is added across series circuit C5010/R5045.

Item	Description	Ordering code

PM3382.

This model has a bandwidth of 100 MHz and no 50Ω input impedance. The channels 3 and 4 only have 2 input sensitivities (0.1 and 0.5 V/div). This realized by:

- The removal of L1001, K1001, C1061, C1062, R1011, R1006, R1007 in CH1.
- C1000 is changed into 3.9 pF (4822 122 31217) in CH1.
- R1012 (1Ω, 4822 051 10108) is added between 'AT1PROT' and 'AT1.50E' in CH1.
- The removal of L2001, K2001, C2061, C2062, R2011, R2006, R2007 in CH2.
- C2000 is changed into 3.9 pF (4822 122 31217) in CH2.
- The removal of L3001, K3001, K3003, K3006, R3011, R3006, R3007, R3021, C3006, C3007 in CH3.
- C3000 is changed into 3.9 pF (4822 122 31217) in CH3.
- C3003 is changed into 5.6 pF/500 V (5322 122 32775) in CH3.
- The bridge wires W3001 and W3002 are added in CH3.
- The removal of L4001, K4001, K4003, K4006, R4011, R4006, R4007, R4021, C4006, C4007 in CH4.
- C4000 is changed into 3.9 pF (4822 122 31217) in CH4.
- C4003 is changed into 5.6 pF/500 V (5322 122 32775) in CH4.
- The bridge wires W4001 and W4002 are added in CH4.
- The bridge wire W4003 is added between 'AT4PROT' (N1109/9) and 'AT4.50E' in CH4.
- R5043 is changed from 162 into 237Ω (4822 116 82882).
- R5069 and R5070 are changed from 1.96 into 2.61 kΩ (4822 111 91821).
- C5010 is changed from 100 into 47 pF (5322 122 32452).
- R5045 is changed from 10 into 19.6 kΩ (5322 116 82901).
- C5015 is changed from 2.7 into 2.2 pF (5322 122 32774).
- R5059 is changed from 316 into 196Ω (4822 111 91817).
- R5048 and R5049 are changed from 46.4 into 68.1Ω.
- R5051 and R5052 are changed from 51.1 into 75Ω (4822 111 91937).
- R5055 and C5016 are removed.

A series circuit C5012 (2.7 pF, 5322 122 31873) and R5054 (1.47 kΩ, 5322 111 91902) is added across series circuit C5010/R5045.

5.1.7 Parts list

CAPACITORS

Item	Description		Ordering code
C 1000	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 1001	CAP.FOIL	400V 10% 22nF	5322 121 40308
C 1002	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1003	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 1004	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 1006	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 1007	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 1008	CAP.CHIP	63V 0.25pF 3.3pF	5322 122 32286
C 1011	CAP.CHIP	63V 5% 33pF	5322 122 32659
C 1012	CAP.CHIP	63V 5% 33pF	5322 122 32659
C 1014	CAP.CHIP	63V 0.5pF 6.8pF	5322 122 32269
C 1018	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1019	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1020	CAP.CERAMIC	500V 0.25pF 2.2pF	5322 122 32774
C 1021	CAP.CERAMIC	500V 10% 1nF	5322 122 32127
C 1022	CAP.CHIP	63V 0.5pF 6.8pF	5322 122 32269
C 1023	CAP.CHIP	63V 5% 470pF	5322 122 32268
C 1025	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1027	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1031	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1041	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1042	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1044	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1045	CAP.ELECTROLYT.	500V 20% 47µF	5322 121 10472
C 1046	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1047	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1048	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1051	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1054	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1055	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 1056	CAP.CERAMIC	63V 5% 10pF	5322 122 32448
C 1057	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 1058	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 1059	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 1060	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 1061	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1062	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1063	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1064	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1066	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1067	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1068	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1069	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1071	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1072	CAP.CHIP	63V 10% 10nF	5322 122 34098

Item	Description		Ordering code
C 1076	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1077	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1082	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1085	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 1086	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1087	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 1088	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1101	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1102	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1151	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1153	CAP.CHIP	63V 10% 1.5nF	4822 122 33174
C 1156	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 1157	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1158	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 1159	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1201	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1204	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1205	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 1208	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1209	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1210	CAP.CERAMIC	63V 5% 47pF	5322 122 32452
C 1211	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1250	CAP.CHIP	63V 10% 10nF	4822 122 34098
C 1251	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1252	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1253	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 1254	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1301	CAP.CERAMIC	63V 5% 47pF	5322 122 32452
C 1302	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1303	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 1304	CAP.CERAMIC	63V 5% 10pF	5322 122 32448
C 1611	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1651	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 1652	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1653	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 1654	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1656	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 1657	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1658	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 1659	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1661	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1662	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1668	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 1669	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1901	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 1903	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 1904	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 1906	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 1931	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228

Item	Description		Ordering code
C 1932	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 2000	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 2001	CAP.FOIL	400V 10% 22nF	5322 121 40308
C 2002	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 2003	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 2004	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 2006	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 2007	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 2008	CAP.CHIP	63V 0.25pF 3.3pF	5322 122 32286
C 2011	CAP.CHIP	63V 5% 33pF	5322 122 32659
C 2012	CAP.CHIP	63V 5% 33pF	5322 122 32659
C 2014	CAP.CHIP	63V 0.5pF 6.8pF	5322 122 32269
C 2018	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2019	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2020	CAP.CERAMIC	500V 0.25pF 2.2pF	5322 122 32774
C 2021	CAP.CERAMIC	500V 10% 1nF	5322 122 32127
C 2022	CAP.CHIP	63V 0.5pF 6.8pF	5322 122 32269
C 2023	CAP.CHIP	63V 5% 470pF	5322 122 32268
C 2025	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 2027	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2031	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2041	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 2042	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2044	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2045	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 2046	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2047	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2048	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2051	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2054	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2055	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 2056	CAP.CERAMIC	63V 5% 10pF	5322 122 32448
C 2057	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 2058	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 2059	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 2060	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 2061	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2062	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2063	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2064	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2066	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2067	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2068	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2069	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2071	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2072	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2076	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2077	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2085	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 2086	CAP.CHIP	63V 10% 10nF	5322 122 34098

Item	Description		Ordering code
C 2087	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 2088	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2101	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2102	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2201	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2204	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 2205	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 2208	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2209	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2210	CAP.CERAMIC	63V 5% 47pF	5322 122 32452
C 2211	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 2301	CAP.CERAMIC	63V 5% L47pF	5322 122 32452
C 2302	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2303	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 2304	CAP.CERAMIC	63V 5% 10pF	5322 122 32448
C 3000	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 3001	CAP.FOIL	400V 10% 22nF	5322 121 40308
C 3002	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3003	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 3004	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 3006	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 3007	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 3008	CAP.CHIP	63V 0.25pF 3.3pF	5322 122 32286
C 3011	CAP.CHIP	63V 5% 33pF	5322 122 32659
C 3012	CAP.CHIP	63V 5% 33pF	5322 122 32659
C 3014	CAP.CHIP	63V 0.5pF 6.8pF	5322 122 32269
C 3018	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3019	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3020	CAP.CERAMIC	500V 0.25pF 2.2pF	5322 122 32774
C 3021	CAP.CERAMIC	500V 10% 1nF	5322 122 32127
C 3022	CAP.CHIP	63V 0.5pF 6.8pF	5322 122 32269
C 3023	CAP.CHIP	63V 5% 470pF	5322 122 32268
C 3025	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3027	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3031	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3041	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3042	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3044	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3045	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 3046	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3047	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3048	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3051	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3054	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3055	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 3056	CAP.CERAMIC	63V 5% 10pF	5322 122 32448
C 3057	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 3058	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 3059	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 3060	CAP.CHIP	63V 5% 100pF	5322 122 32531

Item	Description		Ordering code
C 3061	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3062	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3063	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3064	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3066	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3067	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3068	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3069	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3071	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3072	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3076	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3077	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3085	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 3086	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3087	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 3088	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3101	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3102	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3201	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3204	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3205	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 3208	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3209	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3210	CAP.CERAMIC	63V 5% 47pF	5322 122 32452
C 3211	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3301	CAP.CERAMIC	63V 5% 47pF	5322 122 32452
C 3302	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3303	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 3304	CAP.CERAMIC	63V 5% 10pF	5322 122 32448
C 4000	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 4001	CAP.FOIL	400V 10% 22nF	5322 121 40308
C 4002	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 4003	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 4004	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 4006	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 4007	CAP.CERAMIC	500V 0.25pF 3.3pF	4822 122 31188
C 4008	CAP.CHIP	63V 0.25pF 3.3pF	5322 122 32286
C 4011	CAP.CHIP	63V 5% 33pF	5322 122 32659
C 4012	CAP.CHIP	63V 5% 33pF	5322 122 32659
C 4014	CAP.CHIP	63V 0.5pF 6.8pF	5322 122 32269
C 4018	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4019	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4020	CAP.CERAMIC	500V 0.25pF 2.2pF	5322 122 32774
C 4021	CAP.CERAMIC	500V 10% 1nF	5322 122 32127
C 4022	CAP.CHIP	63V 0.5pF 6.8pF	5322 122 32269
C 4023	CAP.CHIP	63V 5% 470pF	5322 122 32268
C 4025	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 4027	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4031	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4041	CAP.CHIP	63V 10% 100nF	4822 122 33496

Item	Description		Ordering code
C 4042	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4044	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4045	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 4046	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4047	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4048	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4051	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4054	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4055	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 4056	CAP.CERAMIC	63V 5% 10pF	5322 122 32448
C 4057	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 4058	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 4059	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 4060	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 4061	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4062	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4063	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4064	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4066	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4067	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4068	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4069	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4071	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4072	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4076	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4077	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4085	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 4086	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4087	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 4088	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4101	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4102	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4201	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4204	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 4205	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 4208	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4209	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4210	CAP.CERAMIC	63V 5% 47pF	5322 122 32452
C 4211	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 4301	CAP.CERAMIC	63V 5% 47pF	5322 122 32452
C 4302	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4303	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 4304	CAP.CERAMIC	63V 5% 10pF	5322 122 32448
C 5000	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 5001	CAP.CHIP	63V 5% 470pF	5322 122 32268
C 5002	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5003	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5004	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5005	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5006	CAP.CHIP	63V 10% 10nF	5322 122 34098

Item	Description		Ordering code
C 5007	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5008	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5011	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5012	CAP.CERAMIC	63V 5% 10pF	5322 122 32448
C 5015	CAP.CHIP	63V 5% 330pF	5322 122 31863
C 5017	CAP.CERAMIC	63V 0.25pF 0.56pF	5322 122 33083
C 5018	CAP.CERAMIC	63V 0.25pF 0.56pF	5322 122 33083
C 5501	CAP.CHIP	63V 5% 820pF	5322 126 10184
C 5502	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5503	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5504	CAP.CHIP	63V 5% 22pF	5322 122 32658
C 5505	CAP.CHIP	63V 5% 820pF	5322 126 10184
C 5506	CAP.CHIP	63V 10% 1.5nF	4822 122 33174
C 5507	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5508	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5509	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5510	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5511	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5513	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5514	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 5601	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 5602	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 5603	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 5604	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6000	CAP.FOIL	50V 20% 6.8µF	5322 124 42389
C 6001	CAP.ELECTROLYT.	25 20% 180µF	5322 124 42228
C 6002	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6003	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6004	CAP.CHIP	63V 5% 330pF	5322 122 31863
C 6005	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 6006	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 6007	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6008	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6009	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6011	CAP.FOIL	630V 5% 68pF	5322 121 70118
C 6012	CAP.FOIL	63V 5% 10nF	5322 121 70116
C 6013	CAP.ELECTROLYT.	100V 10% 10µF	5322 124 20164
C 6014	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6015	CAP.CERAMIC	63V 0.5pF 5.6pF	5322 122 32967
C 6016	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 6017	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 6018	CAP.FOIL	50V 20% 6.8µF	5322 124 42389
C 6031	CAP.CHIP	63V 10% 1.5nF	4822 122 33174
C 6032	CAP.CHIP	63V 10% 1.5nF	4822 122 33174
C 6033	CAP.CHIP	63V 5% 330pF	5322 122 31863
C 6035	CAP.FOIL	63V 10% 100nF	5322 121 42386
C 6038	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6039	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 6070	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 6071	CAP.CHIP	63V 10% 100nF	4822 122 33496

Item	Description		Ordering code
C 6080	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 6093	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 6094	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 6095	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 6096	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 6097	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 6098	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 6101	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6102	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6103	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6104	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6105	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6106	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6107	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6108	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6109	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6110	CAP.CHIP	63V 5% 470pF	5322 122 32268
C 6111	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6112	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6113	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6114	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6115	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6116	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6117	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6118	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6305	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6415	CAP.ELECTROLYT.	50V 20% 10µF	5322 124 21731
C 6504	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 6549	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 6551	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 6557	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 6559	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 6561	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 6562	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 6581	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 6617	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 6623	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 6624	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6639	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 6642	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 6644	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 6647	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 6648	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6649	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6707	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 6751	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 6758	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 6768	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6773	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6777	CAP.CHIP	63V 10% 100nF	4822 122 33496

Item	Description		Ordering code
C 6779	CAP.CHIP	63V 5% 22pF	5322 122 32658
C 6787	CAP.CHIP	63V 5% 820pF	5322 126 10184
C 6902	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 6903	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 6904	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 6912	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 6913	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 6922	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 6923	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 6924	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 6932	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 6933	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 6934	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 6942	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 6943	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 6953	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 6962	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 6963	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 7001	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 7002	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 7003	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 7004	CAP.CHIP	63V 5% 330pF	5322 122 31863
C 7005	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 7006	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 7007	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 7008	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 7009	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 7010	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 7011	CAP.FOIL	630V 5% 82pF	5322 121 70119
C 7012	CAP.FOIL	63V 5% 10nF	5322 121 70116
C 7013	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 7014	CAP.CERAMIC	63V 0.5pF 5.6pF	5322 122 32967
C 7015	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 7016	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 7017	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 7021	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 7033	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 7034	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 7035	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 7036	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 7054	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 7055	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 7060	CAP.CERAMIC	63V 0.25pF 2.7pF	5322 122 31873
C 7091	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 7092	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 7093	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 7099	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 7504	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 7513	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 7549	CAP.CHIP	63V 10% 22nF	5322 122 32654

Item	Description		Ordering code
C 7551	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 7557	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 7559	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 7561	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 7562	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 7581	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 7682	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 7697	CAP.CHIP	63V 5% 33pF	5322 122 32659
C 7751	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 7813	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 7902	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 7903	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 7904	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 7912	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 7913	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 7923	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 7932	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 7933	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 7934	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 7942	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 7943	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 7962	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 7963	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8000	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8001	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8002	CAP.CHIP	63V 10% 1.5nF	4822 122 33174
C 8003	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8004	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8005	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8006	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8007	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8010	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8011	CAP.ELECTROLYT.	50V 20% 10µF	5322 124 21731
C 8013	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 8014	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8015	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8016	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8017	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8020	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8021	CAP.CERAMIC	63V 5% 22pF	5322 122 32658
C 8022	CAP.CERAMIC	63V 5% 22pF	5322 122 32658
C 8034	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8035	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8036	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8060	CAP.CERAMIC	63V 0.25pF 0.56pF	5322 122 33083
C 8062	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 8063	CAP.CHIP	63V 5% 22pF	5322 122 32658
C 8064	CAP.CERAMIC	63V 5% 10pF	5322 122 32448
C 8065	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 8066	CAP.CERAMIC	63V 5% 10pF	5322 122 32448

Item	Description		Ordering code
C 8070	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8071	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8093	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8094	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8095	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8101	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 8401	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 8403	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 8404	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 8405	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 8410	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 8411	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 9011	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 9012	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 9015	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 9016	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 9018	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 9019	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 9020	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 9034	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 9036	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 9041	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 9042	CAP.CHIP	63V 10% 10nF	5322 122 34098

INTEGRATED CIRCUITS

D 1151	INTEGR.CIRCUIT	HEF4053BT PEL	5322 209 14481
D 1152	INTEGR.CIRCUIT	HEF4051BT PEL	5322 209 11446
D 1201	INTEGR.CIRCUIT	OQ0224 INP.CIRC.	5322 209 12457
D 1301	INTEGR.CIRCUIT	OQ0225 OUTP. CIRC.	5322 209 12458
D 2201	INTEGR.CIRCUIT	OQ0224 INP.CIRC.	5322 209 12457
D 2301	INTEGR.CIRCUIT	OQ0225 OUTP.CIRC.	5322 209 12458
D 3201	INTEGR.CIRCUIT	OQ0224 INP.CIRC.	5322 209 12457
D 3301	INTEGR.CIRCUIT	OQ0225 OUTP.CIRC.	5322 209 12458
D 4201	INTEGR.CIRCUIT	OQ0224 INP.CIRC.	5322 209 12457
D 4301	INTEGR.CIRCUIT	OQ0225 OUTP.CIRC.	5322 209 12458
D 5001	INTEGR.CIRCUIT	HEF4066BT PEL	5322 209 14542
D 5501	INTEGR.CIRCUIT	HEF4053BT PEL	5322 209 14481
D 5502	INTEGR.CIRCUIT	HEF4053BT PEL	5322 209 14481
D 5503	INTEGR.CIRCUIT	HEF4081BT PEL	5322 209 14483
D 6001	INTEGR.CIRCUIT	HEF4051BT PEL	5322 209 11446
D 6002	INTEGR.CIRCUIT	HEF4053BT PEL	5322 209 14481
D 6011	INTEGR.CIRCUIT	OQ0228 SAW CHIP	5322 209 12466
D 6541	INTEGR.CIRCUIT	OQ0226 TRIG AMP	5322 209 12464
D 6621	INTEGR.CIRCUIT	OQ0128 PEAK DET	5322 209 82925
D 6779	INTEGR.CIRCUIT	PC74HCT112T PEL	5322 209 11825
D 6781	INTEGR.CIRCUIT	HEF4053BT PEL	5322 209 14481
D 7001	INTEGR.CIRCUIT	HEF4051BT PEL	5322 209 11446
D 7002	INTEGR.CIRCUIT	HEF4053BT PEL	5322 209 14481
D 7004	INTEGR.CIRCUIT	HEF4052BT PEL	5322 209 11102
D 7005	INTEGR.CIRCUIT	PC74HCT14T PEL	5322 209 71568

Item	Description		Ordering code
D 7011	INTEGR.CIRCUIT	OQ0228 SAW CHIP	5322 209 14481
D 8003	INTEGR.CIRCUIT	OQ0235 ANALOG Z	5322 209 12461
D 8004	INTEGR.CIRCUIT	OQ0227 TB LOGIC	5322 209 12465
D 8006	INTEGR.CIRCUIT	HEF40106BT PEL	5322 209 14486
D 9001	INTEGR.CIRCUIT	TEA1017/N9 PEL	5322 209 60191
D 9002	INTEGR.CIRCUIT	TEA1017/N9 PEL	5322 209 60191
D 9003	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
D 9004	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
D 9006	INTEGR.CIRCUIT	TEA1017/N9 PEL	5322 209 60191
D 9007	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
D 9008	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
D 9009	INTEGR.CIRCUIT	OQ0200 DISP MOD	5322 209 82924
D 9011	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
D 9012	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
D 9013	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
N 1001	INTEGR.CIRCUIT	AD548JR AND	5322 209 31298
N 1101	INTEGR.CIRCUIT	LM339D SIG	5322 209 70684
N 1102	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 1103	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 1104	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N 1202	INTEGR.CIRCUIT	LM324M NSC	5322 209 61473
N 1251	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 2001	INTEGR.CIRCUIT	AD548JR AND	5322 209 31298
N 2202	INTEGR.CIRCUIT	LM324M NSC	5322 209 61473
N 3001	INTEGR.CIRCUIT	AD548JR AND	5322 209 31298
N 3102	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 3103	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 3202	INTEGR.CIRCUIT	LM324M NSC	5322 209 61473
N 4001	INTEGR.CIRCUIT	AD548JR AND	5322 209 31298
N 4202	INTEGR.CIRCUIT	LM324M NSC	5322 209 61473
N 5001	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 5002	INTEGR.CIRCUIT	LM3046M NSC	5322 209 30229
N 6006	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N 6007	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 6008	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 7006	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N 7007	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 7014	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N 7015	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N 7016	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 7951	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 8005	INTEGR.CIRCUIT	DA8444AT/N2 PEL	5322 209 30233
N 9001	INTEGR.CIRCUIT	DA8444AT/N2 PEL	5322 209 30233
N 9002	INTEGR.CIRCUIT	DA8444AT/N2 PEL	5322 209 30233
N 9003	INTEGR.CIRCUIT	DA8444AT/N2 PEL	5322 209 30233

Item	Description		Ordering code
PULSE RELAYS			
K 1001	RELAY	RAL3W-K	5322 280 80745
K 1002	RELAY	RAL3W-K	5322 280 80745
K 1003	RELAY	RAL3W-K	5322 280 80745
K 1004	RELAY	RAL3W-K	5322 280 80745
K 1006	RELAY	RAL3W-K	5322 280 80745
K 2001	RELAY	RAL3W-K	5322 280 80745
K 2002	RELAY	RAL3W-K	5322 280 80745
K 2003	RELAY	RAL3W-K	5322 280 80745
K 2004	RELAY	RAL3W-K	5322 280 80745
K 2006	RELAY	RAL3W-K	5322 280 80745
K 3001	RELAY	RAL3W-K	5322 280 80745
K 3002	RELAY	RAL3W-K	5322 280 80745
K 3003	RELAY	RAL3W-K	5322 280 80745
K 3004	RELAY	RAL3W-K	5322 280 80745
K 3006	RELAY	RAL3W-K	5322 280 80745
K 4001	RELAY	RAL3W-K	5322 280 80745
K 4002	RELAY	RAL3W-K	5322 280 80745
K 4003	RELAY	RAL3W-K	5322 280 80745
K 4004	RELAY	RAL3W-K	5322 280 80745
K 4006	RELAY	RAL3W-K	5322 280 80745
COILS			
L 1001	COIL	056UH 5% TDK	5322 157 63381
L 2001	COIL	056UH 5% TDK	5322 157 63381
L 3001	COIL	056UH 5% TDK	5322 157 63381
L 4001	COIL	056UH 5% TDK	5322 157 63381
L 6096	COIL	2.0UH TDK	4822 157 51757
L 6097	COIL	2.0UH TDK	4822 157 51757
RESISTORS			
R 1001	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R 1002	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 1006	RES.METAL FILM	MRS25 1% 100E	4822 050 21001
R 1007	RES.METAL FILM	MRS25 1% 100E	4822 050 21001
R 1008	RES.METAL FILM	1/4W 0.1% 9K4	5322 116 83712
R 1009	RES.METAL FILM	1/4W 0.1% 300E	5322 116 51814
R 1010	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 1011	RES.N.T.C.	NTC640 2% 3K3	5322 116 30421
R 1013	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 1014	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1016	RES.METAL FILM	0.4W 0.1% 900K	5322 116 51832
R 1019	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1021	RES.METAL FILM	0.4W 0.1% 990K	5322 116 83104
R 1022	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 1023	RES.METAL FILM	1/4W 0.1% 11K1	5322 116 83101

Item	Description		Ordering code
R 1024	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 1026	RES.CHIP	RMC1/8 1% 90E9	5322 111 92018
R 1027	RES.METAL FILM	1/4W 0.1% 111K	5322 116 83099
R 1028	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1029	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1030	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 1031	RES.METAL FILM	0.4W 0.1% 500K	5322 116 83103
R 1032	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 1033	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 1034	RES.CHIP	RC-01 5% 10M	4822 051 10106
R 1035	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1036	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1037	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 1038	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1039	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1041	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1042	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 1043	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1044	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1045	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1046	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 1047	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 1048	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 1049	RES.CHIP	RC-01 5% 10M	4822 051 10106
R 1052	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1053	RES.CHIP	RC-02H 1% 6K19	4822 051 56192
R 1054	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1056	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 1057	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1061	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1062	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 1063	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 1064	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 1065	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 1071	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R 1072	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 1073	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1074	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 1076	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1077	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1078	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 1079	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 1081	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1082	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1083	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1084	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1086	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1087	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 1088	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1092	RES.CHIP	RC-02H 1% 13K3	4822 051 51333

Item	Description		Ordering code
R 1093	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1094	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 1095	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1096	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1097	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1101	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 1102	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1103	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1104	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1106	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1112	RES.CHIP	RC-02H 1% 61K9	4822 051 56193
R 1113	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 1114	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1141	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1151	RES.CHIP	RC-02H 1% 61K9	4822 051 56193
R 1152	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 1153	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 1154	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1155	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1156	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 1157	RES.METAL FILM	1/4W 0.1% 9K4	5322 116 83712
R 1158	RES.METAL FILM	1/4W 0.1% 750E	5322 116 53173
R 1159	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 1192	RES.METAL FILM	1/4W 0.1% 1K25	5322 116 53177
R 1193	RES.METAL FILM	1/4W 0.1% 750E	5322 116 53173
R 1194	RES.METAL FILM	1/4W 0.1% 250E	5322 116 53166
R 1195	RES.METAL FILM	1/4W 0.1% 125E	5322 116 53176
R 1196	RES.METAL FILM	1/4W 0.1% 75E	5322 116 53168
R 1197	RES.METAL FILM	1/4W 0.1% 50E	5322 116 53165
R 1200	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1201	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 1202	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 1203	RES.CHIP	RC-02H 1% 11K	4822 051 51103
R 1204	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 1205	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 1206	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1207	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 1208	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 1209	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1210	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 1211	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 1212	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 1213	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 1214	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 1215	RES.CHIP	RC-02H 1% 348E	4822 051 53481
R 1216	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1217	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1218	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1220	RES.CHIP	RC-02H 1% 75K	4822 051 57503
R 1222	RES.CHIP	RC-02H 1% 162E	4822 051 51621

Item	Description		Ordering code
R 1223	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 1224	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 1226	RES.CHIP	RC-02H 1% 162E	4822 051 51621
R 1227	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R 1228	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 1229	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1231	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 1251	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1252	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1253	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1254	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1256	RES.CHIP	RC-02H 1% 9K09	4822 051 59092
R 1257	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1258	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1259	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 1260	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 1262	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1266	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1301	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R 1302	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R 1303	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 1304	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 1306	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1307	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1308	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 1309	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 1311	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 1312	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1313	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1314	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1612	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 1613	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 1651	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 1652	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 1653	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1654	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1656	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 1657	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 1661	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1662	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1663	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1901	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1902	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1903	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1904	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1906	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1911	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1912	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1913	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1914	RES.CHIP	RMC1/8 1% 10E	4822 111 91885

Item	Description		Ordering code
R 1921	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1922	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1923	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1924	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1926	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1927	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1928	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1929	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1951	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1961	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2001	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R 2002	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 2006	RES.METAL FILM	MRS25 1% 100E	4822 050 21001
R 2007	RES.METAL FILM	MRS25 1% 100E	4822 050 21001
R 2008	RES.METAL FILM	1/4W 0.1% 9K4	5322 116 83712
R 2009	RES.METAL FILM	1/4W 0.1% 300E	5322 116 51814
R 2010	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2011	RES.N.T.C.	NTC640 2% 3K3	5322 116 30421
R 2013	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2014	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 2016	RES.METAL FILM	0.4W 0.1% 900K	5322 116 51832
R 2019	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 2021	RES.METAL FILM	0.4W 0.1% 990K	5322 116 83104
R 2022	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2023	RES.METAL FILM	1/4W 0.1% 11K1	5322 116 83101
R 2024	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 2026	RES.CHIP	RMC1/8 1% 90E9	5322 111 92018
R 2027	RES.METAL FILM	1/4W 0.1% 111K	5322 116 83099
R 2028	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2029	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2030	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2031	RES.METAL FILM	0.4W 0.1% 500K	5322 116 83103
R 2032	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 2033	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 2034	RES.CHIP	RC-01 5% 10M	4822 051 10106
R 2035	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2036	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 2037	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 2038	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2039	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 2041	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 2042	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 2043	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 2044	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 2045	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 2046	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 2047	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 2048	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 2049	RES.CHIP	RC-01 5% 10M	4822 051 10106
R 2052	RES.CHIP	RC-02H 1% 100E	4822 051 51001

Item	Description		Ordering code
R 2053	RES.CHIP	RC-02H 1% 6K19	4822 051 56192
R 2054	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2056	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 2057	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 2061	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2062	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 2063	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 2064	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 2065	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 2071	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R 2072	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 2073	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 2074	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 2076	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2077	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2078	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 2079	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 2081	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2082	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2083	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 2084	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 2086	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2087	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 2088	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2092	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 2093	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2094	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 2096	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 2101	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 2102	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2103	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2104	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2106	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2112	RES.CHIP	RC-02H 1% 61K9	4822 051 56193
R 2113	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 2114	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2200	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 2201	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 2202	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 2203	RES.CHIP	RC-02H 1% 11K	4822 051 51103
R 2204	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 2205	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 2206	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 2207	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 2208	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 2209	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 2210	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 2211	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 2212	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 2213	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895

Item	Description		Ordering code
R 2214	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 2215	RES.CHIP	RC-02H 1% 348E	4822 051 53481
R 2216	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 2217	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 2218	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2220	RES.CHIP	RC-02H 1% 75K	4822 051 57503
R 2222	RES.CHIP	RC-02H 1% 162E	4822 051 51621
R 2223	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 2224	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 2226	RES.CHIP	RC-02H 1% 162E	4822 051 51621
R 2227	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R 2228	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 2229	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2231	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 2301	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2302	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2303	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 2304	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 2307	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 2308	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 2309	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 2311	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 2313	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2314	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3001	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R 3002	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 3006	RES.METAL FILM	MRS25 1% 100E	4822 050 21001
R 3007	RES.METAL FILM	MRS25 1% 100E	4822 050 21001
R 3008	RES.METAL FILM	1/4W 0.1% 9K4	5322 116 83712
R 3009	RES.METAL FILM	1/4W 0.1% 300E	5322 116 51814
R 3010	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3011	RES.N.T.C.	NTC640 2% 3K3	5322 116 30421
R 3013	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3014	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3016	RES.METAL FILM	0.4W 0.1% 900K	5322 116 51832
R 3019	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3021	RES.METAL FILM	0.4W 0.1% 990K	5322 116 83104
R 3022	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3023	RES.METAL FILM	1/4W 0.1% 11K1	5322 116 83101
R 3024	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 3026	RES.CHIP	RMC1/8 1% 90E9	5322 111 92018
R 3027	RES.METAL FILM	1/4W 0.1% 111K	5322 116 83099
R 3028	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3029	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3030	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3031	RES.METAL FILM	0.4W 0.1% 500K	5322 116 83103
R 3032	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 3033	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 3034	RES.CHIP	RC-01 5% 10M	4822 051 10106
R 3035	RES.CHIP	RC-02H 1% 215K	4822 051 52154

Item	Description		Ordering code
R 3036	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 3037	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 3038	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 3039	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 3041	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 3042	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 3043	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 3044	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 3045	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 3046	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 3047	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 3048	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 3049	RES.CHIP	RC-01 5% 10M	4822 051 10106
R 3052	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3053	RES.CHIP	RC-02H 1% 6K19	4822 051 56192
R 3054	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3056	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 3057	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 3061	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3062	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 3063	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 3064	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 3065	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 3071	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R 3072	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 3073	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3074	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 3076	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3077	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3078	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 3079	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 3081	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3082	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3083	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 3084	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 3086	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3087	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 3088	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3092	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 3093	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3094	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 3096	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 3101	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 3102	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3103	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3104	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3106	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3112	RES.CHIP	RC-02H 1% 61K9	4822 051 56193
R 3113	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 3114	RES.CHIP	RC-02H 1% 10K	4822 051 51003

Item	Description		Ordering code
R 3200	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3201	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 3202	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 3203	RES.CHIP	RC-02H 1% 11K	4822 051 51103
R 3204	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 3205	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 3206	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3207	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 3208	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 3209	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 3210	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 3211	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 3212	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 3213	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 3214	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 3215	RES.CHIP	RC-02H 1% 348E	4822 051 53481
R 3216	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3217	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3218	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3220	RES.CHIP	RC-02H 1% 75K	4822 051 57503
R 3222	RES.CHIP	RC-02H 1% 162E	4822 051 51621
R 3223	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 3224	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 3226	RES.CHIP	RC-02H 1% 162E	4822 051 51621
R 3227	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R 3228	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 3229	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 3231	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 3301	RES.MET.GLAZED	RMC1/8 1% 46E4	5322 116 82896
R 3302	RES.MET.GLAZED	RMC1/8 1% 46E4	5322 116 82896
R 3303	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 3304	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 3307	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 3308	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 3309	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 3311	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 3313	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3314	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 4001	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R 4002	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 4006	RES.METAL FILM	MRS25 1% 100E	4822 050 21001
R 4007	RES.METAL FILM	MRS25 1% 100E	4822 050 21001
R 4008	RES.METAL FILM	1/4W 0.1% 9K4	5322 116 83712
R 4009	RES.METAL FILM	1/4W 0.1% 300E	5322 116 51814
R 4010	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 4011	RES.N.T.C.	NTC640 2% 3K3	5322 116 30421
R 4013	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 4014	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4016	RES.METAL FILM	0.4W 0.1% 900K	5322 116 51832
R 4019	RES.CHIP	RC-02H 1% 100E	4822 051 51001

Item	Description		Ordering code
R 4021	RES.METAL FILM	0.4W 0.1% 990K	5322 116 83104
R 4022	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 4023	RES.METAL FILM	1/4W 0.1% 11K1	5322 116 83101
R 4024	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 4026	RES.CHIP	RMC1/8 1% 90E9	5322 111 92018
R 4027	RES.METAL FILM	1/4W 0.1% 111K	5322 116 83099
R 4028	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 4029	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 4030	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 4031	RES.METAL FILM	0.4W 0.1% 500K	5322 116 83103
R 4032	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 4033	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 4034	RES.CHIP	RC-01 5% 10M	4822 051 10106
R 4035	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 4036	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 4037	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 4038	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 4039	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 4041	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 4042	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 4043	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 4044	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 4045	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 4046	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 4047	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 4048	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 4049	RES.CHIP	RC-01 5% 10M	4822 051 10106
R 4052	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4053	RES.CHIP	RC-02H 1% 6K19	4822 051 56192
R 4054	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 4056	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 4057	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 4061	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 4062	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 4063	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 4064	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 4065	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 4071	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R 4072	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 4073	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4074	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 4076	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 4077	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 4078	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 4079	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 4081	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 4082	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 4083	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 4084	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 4086	RES.CHIP	RC-02H 1% 10K	4822 051 51003

Item	Description		Ordering code
R 4087	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 4088	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 4092	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 4093	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 4094	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 4096	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 4101	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 4102	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 4103	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 4104	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 4106	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 4112	RES.CHIP	RC-02H 1% 61K9	4822 051 56193
R 4113	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 4114	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 4200	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4201	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 4202	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 4203	RES.CHIP	RC-02H 1% 11K	4822 051 51103
R 4204	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 4205	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 4206	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4207	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 4208	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 4209	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 4210	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 4211	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 4212	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 4213	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 4214	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 4215	RES.CHIP	RC-02H 1% 348E	4822 051 53481
R 4216	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4217	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4218	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 4220	RES.CHIP	RC-02H 1% 75K	4822 051 57503
R 4222	RES.CHIP	RC-02H 1% 162E	4822 051 51621
R 4223	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 4224	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 4226	RES.CHIP	RC-02H 1% 162E	4822 051 51621
R 4227	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R 4228	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 4229	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 4231	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 4301	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 4302	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 4303	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 4304	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 4307	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 4308	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 4309	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 4311	RES.CHIP	RC-02H 1% 19K6	4822 051 51963

Item	Description		Ordering code
R 4313	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 4314	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 5001	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 5002	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 5003	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5004	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 5006	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 5007	RES.CHIP	RC-02H 1% 348E	4822 051 53481
R 5008	RES.CHIP	RC-02H 1% 348E	4822 051 53481
R 5009	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 5011	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 5012	RES.CHIP	RC-02H 1% 162E	4822 051 51621
R 5013	RES.CHIP	RC-02H 1% 162E	4822 051 51621
R 5014	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 5016	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5017	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5018	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 5019	RES.CHIP	RC-02H 1% 2K87	4822 051 52872
R 5021	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 5024	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5026	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5027	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5028	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5029	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 5031	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 5032	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 5035	RES.CHIP	RC-02H 1% 348E	4822 051 53481
R 5036	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 5037	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 5041	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 5042	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 5043	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 5044	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 5045	RES.CHIP	RC-02H 1% 9K09	4822 051 59092
R 5046	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 5047	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 5048	RES.MET.GLAZED	RMC1/8 1% 46E4	5322 116 82896
R 5049	RES.MET.GLAZED	RMC1/8 1% 46E4	5322 116 82896
R 5050	RES.CHIP	RC-02H 1% 511K	4822 051 55114
R 5051	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 5052	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 5053	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 5054	RES.CHIP	RC-02H 1% 2K87	4822 051 52872
R 5056	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 5057	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 5058	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 5060	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 5064	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 5065	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5066	RES.CHIP	RC-02H 1% 511K	4822 051 55114

Item	Description		Ordering code
R 5068	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5069	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 5070	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 5071	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 5072	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 5076	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 5501	RES.CHIP	RC-02H 1% 9K09	4822 051 59092
R 5502	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 5503	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 5504	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 5506	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 5507	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 5508	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 5509	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 5510	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 5511	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5512	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 5513	RES.CHIP	RC-02H 1% 422E	4822 051 54221
R 5514	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 5516	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 5517	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 5518	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5519	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 5521	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 5522	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 5523	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 5524	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 5526	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5527	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 5531	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 5532	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 5533	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 5534	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 5536	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 5537	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 5538	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 5539	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 5543	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5544	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 5546	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 5551	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 5552	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 5553	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 5554	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 5556	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5557	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5558	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5559	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5561	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 5562	RES.CHIP	RC-02H 1% 12K1	4822 051 51213

Item	Description		Ordering code
R 5601	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5602	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5603	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 5606	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 6001	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 6002	RES.METAL FILM	1/4W 0.1% 50E	5322 116 53165
R 6003	RES.METAL FILM	1/4W 0.1% 75E	5322 116 53168
R 6004	RES.METAL FILM	1/4W 0.1% 125E	5322 116 53176
R 6005	RES.METAL FILM	1/4W 0.1% 250E	5322 116 53166
R 6006	RES.METAL FILM	1/4W 0.1% 750E	5322 116 53173
R 6007	RES.METAL FILM	1/4W 0.1% 1K25	5322 116 53177
R 6008	RES.METAL FILM	1/4W 0.1% 900E	5322 116 83098
R 6009	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 6011	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R6012	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 6013	RES.METAL FILM	1/4W 0.1% 23K7	5322 116 53169
R 6014	RES.METAL FILM	1/4W 0.1% 2K37	5322 116 53171
R 6015	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 6016	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 6017	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 6018	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 6019	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 6020	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 6021	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 6022	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 6023	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 6024	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 6025	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 6026	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 6027	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 6028	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 6029	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 6030	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 6031	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 6032	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 6033	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 6034	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 6035	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 6036	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 6037	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 6038	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 6040	RES.CHIP	RC-02H 1% 6K19	4822 051 56192
R 6041	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 6042	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 6043	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 6044	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 6045	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 6046	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 6047	RES.CHIP	RC-02H 1% 196E	4822 051 51961
R 6048	RES.CHIP	RC-02H 1% 750E	4822 051 57501

Item	Description		Ordering code
R 6049	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 6050	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 6051	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 6052	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 6053	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 6054	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 6061	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 6062	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 6063	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 6070	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 6071	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 6072	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 6073	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 6074	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 6093	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 6094	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 6101	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 6104	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 6502	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 6503	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 6508	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 6509	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 6511	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 6512	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 6521	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 6522	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 6523	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 6524	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 6526	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 6527	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 6528	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 6529	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 6531	RES.CHIP	RC-02H 1% 422E	4822 051 54221
R 6542	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 6543	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 6544	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 6546	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 6547	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 6548	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 6552	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 6554	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 6556	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 6558	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 6571	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 6572	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 6576	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 6577	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 6578	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 6579	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 6584	RES.CHIP	RC-02H 1% 1K33	4822 051 51332

Item	Description		Ordering code
R 6586	RES.CHIP	RC-02H 1% 1K33	4822 051 51332
R 6601	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 6602	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 6603	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 6612	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 6613	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 6614	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 6616	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 6622	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 6624	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 6626	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 6627	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 6629	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 6632	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 6633	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 6634	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 6636	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 6638	RES.CHIP	RC-01 5% 10M	4822 051 10106
R 6641	RES.CHIP	RC-01 5% 10M	4822 051 10106
R 6643	RES.CHIP	RC-01 5% 10M	4822 051 10106
R 6646	RES.CHIP	RC-01 5% 10M	4822 051 10106
R 6649	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 6661	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 6662	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 6684	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 6688	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 6689	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 6692	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 6694	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 6696	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 6706	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 6708	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 6709	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 6752	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 6753	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 6754	RES.CHIP	RC-02H 1% 348E	4822 051 53481
R 6756	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 6758	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 6762	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 6764	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 6769	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 6772	RES.CHIP	RC-02H 1% 11K	4822 051 51103
R 6774	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 6776	RES.CHIP	RC-02H 1% 511K	4822 051 55114
R 6782	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 6783	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 6788	RES.CHIP	RC-02H 1% 11K	4822 051 51103
R 6901	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 6911	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 6921	RES.CHIP	RC-01 5% 4E7	4822 051 10478

Item	Description		Ordering code
R 6931	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 6941	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 6951	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 6961	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 7001	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 7002	RES.METAL FILM	1/4W 0.1% 50E	5322 116 53165
R 7003	RES.METAL FILM	1/4W 0.1% 75E	5322 116 53168
R 7004	RES.METAL FILM	1/4W 0.1% 125E	5322 116 53176
R 7005	RES.METAL FILM	1/4W 0.1% 250E	5322 116 53166
R 7006	RES.METAL FILM	1/4W 0.1% 750E	5322 116 53173
R 7007	RES.METAL FILM	1/4W 0.1% 1K25	5322 116 53177
R 7008	RES.METAL FILM	1/4W 0.1% 900E	5322 116 83098
R 7009	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 7011	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 7012	RES.CHIP	RC-02H 1% 34K8	4822 051 53482
R 7013	RES.METAL FILM	1/4W 0.1% 23K7	5322 116 53169
R 7014	RES.METAL FILM	1/4W 0.1% 2K37	5322 116 53171
R 7015	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 7016	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 7017	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 7018	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 7019	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 7021	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 7022	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 7023	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 7024	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 7025	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 7026	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 7027	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 7028	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 7029	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 7031	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 7032	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 7033	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 7034	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 7036	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 7041	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 7042	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 7043	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 7044	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 7045	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 7046	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 7047	RES.CHIP	RC-02H 1% 196E	4822 051 51961
R 7048	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 7049	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 7050	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 7051	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 7052	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 7054	RES.CHIP	RC-02H 1% 9K09	4822 051 59092
R 7056	RES.CHIP	RC-02H 1% 19K6	4822 051 51963

Item	Description		Ordering code
R 7057	RES.CHIP	RC-02H 1% 38K3	4822 051 53833
R 7058	RES.CHIP	RC-02H 1% 147K	4822 051 51474
R 7059	RES.CHIP	RC-02H 1% 75K	4822 051 57503
R 7064	RES.METAL FILM	1/4W 0.1% 6K	5322 116 83102
R 7065	RES.METAL FILM	1/4W 0.1% 500E	5322 116 83097
R 7066	RES.METAL FILM	1/4W 0.1% 900E	5322 116 83098
R 7067	RES.METAL FILM	1/4W 0.1% 100E	5322 116 51701
R 7077	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 7078	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 7082	RES.CHIP	RMC1/8 1% 14E7	4822 111 91886
R 7091	RES.METAL FILM	1/4W 0.1% 10K	5322 116 82868
R 7092	RES.METAL FILM	1/4W 0.1% 2K16	5322 116 83126
R 7094	RES.METAL FILM	1/4W 0.1% 10K	5322 116 82868
R 7095	RES.METAL FILM	1/4W 0.1% 10K	5322 116 82868
R 7097	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 7099	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 7144	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 7150	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 7151	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 7152	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 7153	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 7154	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 7155	RES.CHIP	RC-02H 1% 11K	4822 051 51103
R 7156	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 7160	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 7180	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 7181	RES.CHIP	RC-02H 1% 562E	4822 051 55621
R 7204	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 7205	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 7206	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 7207	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 7208	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 7209	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 7502	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 7503	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 7508	RES.CHIP	RC-02H 1% 825E	4822 051 58251
R 7509	RES.CHIP	RC-02H 1% 825E	4822 051 58251
R 7511	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 7512	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 7521	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 7522	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 7523	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 7524	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 7526	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 7527	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 7528	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 7529	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 7531	RES.CHIP	RC-02H 1% 422E	4822 051 54221
R 7542	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 7543	RES.CHIP	RC-02H 1% 5K11	4822 051 55112

Item	Description		Ordering code
R 7544	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 7546	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 7547	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 7548	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 7552	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 7554	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 7556	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 7558	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 7563	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 7571	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 7572	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 7576	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 7577	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 7578	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 7579	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 7584	RES.CHIP	RC-02H 1% 1K33	4822 051 51332
R 7586	RES.CHIP	RC-02H 1% 1K33	4822 051 51332
R 7681	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 7688	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 7689	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 7692	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 7693	RES.CHIP	RC-02H 1% 6K19	4822 051 56192
R 7694	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 7696	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 7711	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 7712	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 7713	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 7716	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 7753	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 7754	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 7809	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 7901	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 7911	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 7921	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 7931	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 7941	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 7951	RES.CHIP	RC-02H 1% 11K	4822 051 51103
R 7952	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 7953	RES.CHIP	RC-02H 1% 11K	4822 051 51103
R 7954	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 7956	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 7957	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 7958	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 7961	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 8001	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 8002	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 8003	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 8004	RES.CHIP	RC-02H 1% 9K09	4822 051 59092
R 8005	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 8006	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821

Item	Description		Ordering code
R 8007	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 8008	CAP.CHIP	RC-02H 1% 2K15	4822 051 52152
R 8009	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 8010	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8011	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 8012	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 8013	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 8014	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8015	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 8016	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8017	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8018	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8020	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 8021	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8022	RES.CHIP	RC-02H 1% 196E	4822 051 51961
R 8023	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 8024	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 8025	RES.CHIP	RC-02H 1% 562E	4822 051 55621
R 8026	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 8027	RES.CHIP	RMC1/8 1% 61E9	5322 111 92016
R 8028	RES.CHIP	RC-02H 1% 196E	4822 051 51961
R 8029	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8030	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 8032	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 8033	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8034	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 8035	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 8036	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8037	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 8038	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 8039	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8040	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 8041	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8042	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8043	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 8044	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 8045	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 8046	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8047	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8048	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 8049	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8050	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8051	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8052	RES.CHIP	RC-02H 1% 6K19	4822 051 56192
R 8053	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8054	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8055	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 8056	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8057	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 8058	RES.CHIP	RC-02H 1% 383E	4822 051 53831

Item	Description		Ordering code
R 8059	RES.CHIP	RC-02H 1% 422E	4822 051 54221
R 8060	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 8061	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8062	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8063	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8064	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8065	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8066	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8067	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8068	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 8069	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8070	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8071	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8072	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8073	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8074	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 8075	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 8076	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 8077	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 8078	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 8079	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 8080	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8081	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 8082	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8083	RES.CHIP	RC-02H 1% 2K87	4822 051 52872
R 8084	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 8085	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 8086	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 8087	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 8088	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8089	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 8090	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 8091	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 8092	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 8093	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 8094	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 8095	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8096	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 8097	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 8098	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 8099	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 8100	RES.CHIP	RC-02H 1% 422E	4822 051 54221
R 8101	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8102	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 8103	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 8104	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 8105	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 8106	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8130	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 8131	RES.CHIP	RC-02H 1% 5K11	4822 051 55112

Item	Description		Ordering code
R 8132	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8133	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8134	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 8135	RES.CHIP	RC-02H 1% 162E	4822 051 51621
R 8136	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 8137	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 8138	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 8200	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8403	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8404	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8405	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8410	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8411	RES.CHIP	RC-02H 1% 100E	4822 051 51001

SEMICONDUCTORS

V 1001	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 1002	DIODE	BBY62 PEL	5322 130 82685
V 1003	DIODE,CHIP	BZX84-C6V8 PEL	5322 130 80406
V 1004	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V 1005	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V 1006	TRANSISTOR,CHIP	BF990A PEL	4822 130 62657
V 1007	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718
V 1009	TRANSISTOR,CHIP	BFR53 PEL	5322 130 61244
V 1012	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 1013	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 1015	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1016	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1017	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 1018	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 1206	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1207	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1208	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1209	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1251	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 1252	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 1301	DIODE,CHIP	BZX84-C6V2 PEL	5322 130 33671
V 1302	DIODE,CHIP	BZX84-C6V8 PEL	5322 130 80406
V 1304	DIODE,CHIP	BZX84-C4V7 PEL	5322 130 31937
V 1306	DIODE,CHIP	BZX84-C2V4 PEL	4822 130 33703
V 1307	DIODE,CHIP	BZX84-C3V0 PEL	5322 130 32739
V 1308	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 1313	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 2001	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 2002	DIODE	BBY62 PEL	5322 130 82685
V 2003	DIODE,CHIP	BZX84-C6V8 PEL	5322 130 80406
V 2004	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V 2005	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V 2006	TRANSISTOR,CHIP	BF990A PEL	4822 130 62657
V 2007	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718
V 2009	TRANSISTOR,CHIP	BFR53 PEL	5322 130 61244

Item	Description		Ordering code
V 2012	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 2013	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 2015	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 2016	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 2017	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 2018	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 2206	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 2207	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 2208	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 2209	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 2301	DIODE,CHIP	BZX84-C6V8 PEL	5322 130 80406
V 2302	DIODE,CHIP	BZX84-C6V8 PEL	5322 130 80406
V 2303	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 2304	DIODE,CHIP	BZX84-C4V7 PEL	5322 130 31937
V 2306	DIODE,CHIP	BZX84-C2V4 PEL	4822 130 33703
V 2307	DIODE,CHIP	BZX84-C3V0 PEL	5322 130 32739
V 3001	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 3002	DIODE	BBY62 PEL	5322 130 82685
V 3003	DIODE,CHIP	BZX84-C6V8 PEL	5322 130 80406
V 3004	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V 3005	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V 3006	TRANSISTOR,CHIP	BF990A PEL	4822 130 62657
V 3007	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718
V 3009	TRANSISTOR,CHIP	BFR53 PEL	5322 130 61244
V 3012	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 3013	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 3015	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 3016	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 3017	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 3018	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 3206	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 3207	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 3208	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 3209	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 3301	DIODE,CHIP	BZX84-C6V8 PEL	5322 130 80406
V 3302	DIODE,CHIP	BZX84-C6V8 PEL	5322 130 80406
V 3303	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 3304	DIODE,CHIP	BZX84-C4V7 PEL	5322 130 31937
V 3306	DIODE,CHIP	BZX84-C2V4 PEL	4822 130 33703
V 3307	DIODE,CHIP	BZX84-C3V0 PEL	5322 130 32739
V 4001	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 4002	DIODE	BBY62 PEL	5322 130 82685
V 4003	DIODE,CHIP	BZX84-C6V8 PEL	5322 130 80406
V 4004	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V 4005	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V 4006	TRANSISTOR,CHIP	BF990A PEL	4822 130 62657
V 4007	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718
V 4009	TRANSISTOR,CHIP	BFR53 PEL	5322 130 61244
V 4012	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 4013	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502

Item	Description		Ordering code
V 4015	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 4016	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 4017	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 4018	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 4206	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 4207	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 4208	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 4209	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 4301	DIODE,CHIP	BZX84-C6V8 PEL	5322 130 80406
V 4302	DIODE,CHIP	BZX84-C6V8 PEL	5322 130 80406
V 4303	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 4304	DIODE,CHIP	BZX84-C4V7 PEL	5322 130 31937
V 4306	DIODE,CHIP	BZX84-C2V4 PEL	4822 130 33703
V 4307	DIODE,CHIP	BZX84-C3V0 PEL	5322 130 32739
V 5001	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718
V 5002	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718
V 5003	TRANSISTOR,CHIP	BFR92 PEL	5322 130 42145
V 5004	TRANSISTOR,CHIP	BFR92 PEL	5322 130 42145
V 5006	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 5007	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 5008	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 5009	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 5011	DIODE,CHIP	BAT17 PEL	5322 130 31544
V 5012	DIODE,CHIP	BAT17 PEL	5322 130 31544
V 5013	DIODE,CHIP	BAT17 PEL	5322 130 31544
V 5014	DIODE,CHIP	BAT17 PEL	5322 130 31544
V 5016	DIODE,CHIP	BZX84-C6V2 PEL	5322 130 33671
V 5017	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 5018	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 5501	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718
V 5502	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718
V 5503	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 5504	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5506	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 5601	DIODE,CHIP	BZX84-C6V2 PEL	5322 130 33671
V 6001	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 6002	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 6003	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 6004	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 6005	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 6006	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 6007	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 6008	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 6012	TRANSISTOR,CHIP	BFR92 PEL	5322 130 42145
V 6013	TRANSISTOR	ON4401 PEL	5322 130 61498
V 6014	TRANSISTOR	ON4401 PEL	5322 130 61498
V 6016	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 6017	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 6018	DIODE,CHIP	BZX84-C5V6 PEL	4822 130 80125
V 6019	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136

Item	Description		Ordering code
V 6022	DIODE,CHIP	BZX84-C5V6 PEL	4822 130 80125
V 6041	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 6042	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 6044	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 6061	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 6062	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 6101	DIODE,CHIP	BZX84-C2V4 PEL	4822 130 33703
V 6506	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 6507	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 6532	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 6553	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 6573	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 6574	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 6593	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 6604	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 6606	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 6628	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 6631	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 6637	DIODE,CHIP	BZX84-C6V8 PEL	5322 130 80406
V 6667	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 6668	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 6686	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 6687	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 6691	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 6754	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 6757	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 6759	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 6761	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 6763	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 6764	DIODE,CHIP	BZX84-C6V2 PEL	5322 130 33671
V 6768	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 7001	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 7003	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 7004	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 7005	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 7006	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 7007	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 7012	TRANSISTOR,CHIP	BFR92 PEL	5322 130 42145
V 7016	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 7017	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 7018	DIODE,CHIP	BZX84-C5V6 PEL	4822 130 80125
V 7019	TRANSISTOR	ON4401 PEL	5322 130 61498
V 7020	TRANSISTOR	ON4401 PEL	5322 130 61498
V 7031	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 7032	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 7075	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 7091	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 7093	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 7094	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 7150	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383

Item	Description		Ordering code
V 7151	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 7152	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 7506	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 7507	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 7532	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 7553	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 7573	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 7574	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 7686	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 7687	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 7691	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 7714	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 7807	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8001	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8002	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8003	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8004	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 8005	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8006	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8007	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8008	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8009	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8011	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 8012	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 8013	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 8014	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 8015	DIODE,CHIP	BZX84-C2V4 PEL	4822 130 33703
V 8018	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8019	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8023	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 8024	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 8028	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 8029	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 8031	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 8040	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8041	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8042	TRANSISTOR,CHIP	BSV52 PEL	5322 130 44336
V 8043	TRANSISTOR,CHIP	BSV52 PEL	5322 130 44336
V 8044	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8061	TRANSISTOR,CHIP	BFR92 PEL	5322 130 42145
V 8062	TRANSISTOR,CHIP	BFR92 PEL	5322 130 42145
V 8063	TRANSISTOR,CHIP	BFR92 PEL	5322 130 42145
V 8065	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 8066	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8067	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8068	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8101	DIODE,CHIP	BAS28 PEL	5322 130 80214

CONNECTORS

X 1301	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 14116
X 1302	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 14116
X 2301	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 14116
X 2302	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 14116
X 3301	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 14116
X 3302	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 14116
X 4301	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 14116
X 4302	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 14116
X 5001	CONNECTOR	4-P HAAKS OMSL	5322 265 30907
X 6010	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 14116
X 6011	CONNECTOR	2-P SNG RT.ANG	5322 265 20525
X 6794	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 14116
X 8010	CONNECTOR	2-P SNG RT.ANG	5322 265 20525
X 8011	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 14116
X 8012	CONNECTOR	2-P SNG RT.ANG	5322 265 20525
X 8013	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 14116
X 8014	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 14116
X 8015	CONNECTOR	2-P SNG RT.ANG	5322 265 20525
X 9001	CONNECTOR	50-P DBL STRGHT	5322 265 61242
X 9002	CONNECTOR	P 1.25MM STR	5322 267 51107

5.2 FINAL XYZ AMPLIFIER A2

5.2.1 Description of A2-200 MHz version

5.2.1.1 Final Y amplifier

Diagram 1

The output signal from the delay line is applied to the input pins 6 and 9 of amplifier IC D1001. Also the vertical output signals YTXT0 and YTXT1 from the digitizer unit A8 are applied to D1001 (pin 15 and 16). The switching between digital and analog mode is done via control signals that are applied to pin 17 and 18 of D1001. Digital mode is active if the voltage at pin 18 is higher than at pin 17. This switching signal is derived from the collector of the transistors V1201 and V1202. The control signals XYSW1 and XYSW0 come from the output stage V8036/V8041 on the digitizer unit A8. Via the transistors V1203 and V1204 similar switching signals XSW1 and XSW0 are routed to the X-deflection section for switching between digital and analog mode.

The output signals from pin 21 and 22 of D1001 are routed to the final Y-amplifier that drives the vertical deflection plates of the CRT. This final stage is indicated on the next diagram.

The delay line leads are terminated into 50Ω. The impedance is composed by 300Ω inside D1001 parallelled by external impedances of 60Ω formed by the external resistors R1024/R1026 and R1027/R1028. All termination resistors are applied to a voltage controlled by D1001/pin 13. Pin 13 determines the common mode voltage level of the D1001 inputs. The HF square wave compensation is achieved by the two dual varicap diodes V1009 and V1011 together with associated resistors. A fixed mid- frequency compensation network is formed by C1006 and associated resistors.
Varicap V1009 is controlled by the output signal at pin 20 of octal DAC N1001. This output voltage can be in the range 0 to 10 V and controls varicap V1009 via operational amplifier N1002/1,2,3. This operational amplifier converts the N1001 output voltage (that is related to 0 V) into a voltage related to the voltage at D1001/pin 13.
Varicap V1011 is controlled by the output signal at pin 18 of octal DAC N1001. This output voltage can be in the range 0 to 10 V and controls varicap V1011 via operational amplifier N1002/5,6,7. This operational amplifier converts the N1001 output voltage (that is related to 0 V) into a voltage related to the voltage at D1001/pin 13.

LF square wave compensation is also done inside D1001. This is controlled via currents applied to pin 27 and 28. These currents are derived from the N1001 DAC voltage outputs 13 and 11 via the transistors V1014 and V1016. The actual compensating components are situated outside D1001 and are R1037/C1011/R1038 and R1029/C1009/R1031. V1023 and V1024 form a 20 mA current source to supply the bias current for the final stage inside D1001. V1024 is switched as a diode and gives temperature compensation.

Offset is adjusted via the currents from the collectors of V1021 and V1022. These currents are controlled by the DAC output pins 17 (Most Significant DAC) and 16 (Least Significant DAC). Two parallel DAC outputs are used to obtain sufficient resolution. V1018 is a current source and V1019 is for temperature compensation. Gain control occurs via an adjustable current applied to D1001/pin 26. This is done via N1001/pin 14 and R1051

DAC output N1001/15 applies via operational amplifier N1003/1,2,3 the signal YFSHF to the final stage on the next diagram. YFSHF is an adjustable dc voltage that is applied to varicap diodes that control the HF square wave response.

Diagram 2

This diagram shows the push-pull output amplifier. The input signal is a current and the output signal is a voltage. The output signal is applied to the vertical upper and lower plates of the CRT. The total sensitivity at the plates is 4V/div. One plate is driven by push-pull stage V1106/V1111. The driver transistors are V1102 and V1103. The input signal is YPREOUT1.

The other plate is driven by push-pull stage V1107/V1112. The driver transistors are V1101 and V1104. The input signal is YPREOUT0. The output voltage applied to the CRT deflection plates is controlled by the feedback networks R1101/R1141/R1143/C1101/V1113/R1140/C1121 and R1102/R1142/R1144/C1102/V1113/R1145/C1122.

The push-pull amplifier stages are connected between +18 V and -18V supply voltages via current sources. One of these is V1122 with temperature compensation via V1121. The other is V1123 and is adjusted via operational amplifier N1003/5,6,7. This assures that the common mode voltage at the plates of the CRT is 0 V.
The resistance network between L1101 and L1102 avoids extreme differences in power dissipation in the output transistors when a dc voltage difference exists between the CRT deflection plates.

The input of the final stage is at a common mode level of 9V dc because of the output level from D1001. This voltage is made by the dc current sources V1021 and V1022. The current from these sources is partly used by the D1001 output stage (pin 21 and 22). The remaining currents give a 9 V dc across the feedback resistors R1101/R1141 and R1102/1142. Because the output lines to the CRT plates are at 0V common mode level, the inputs are at 9V common mode level. The current in the feedback resistors runs via L1101, L1102 and V1126 to the -18V supply.

The bias current for the driver stage V1101/V1102/V1103/V1104 is controlled by V1127 and V1128 via R1167 and R1168. V1127 converts voltage into current. This current is compared with current from source V1128/R1166. In case of a difference between these currents, the resulting current feeds the base of V1103 and V1104.

The circuit with operational amplifier N1004/2,3,6 is used for automatic calibration of the vertical deflection. It measures the voltage at the vertical deflection plates of the CRT. This value is applied as signal YCAL to the microprocessor on unit A3.

5.2.1.2 Final X and Z amplifiers

Diagram 3

This diagram shows the final X amplifier. It drives the horizontal plates of the CRT. The plate sensitivity equals 8.5 V/div. The input circuit is formed by IC D2001. The octal DAC N2002 supplies the analog control signals that are used throughout the circuit.

Input pin 5 and 6 of D2001 receive the analog time base sawtooth or the X-deflection signal. Input pin 9 and 10 receive the X-deflection signals XTXT0 and XTXT1 from digitizer unit A8. The selection between analog and digital mode is done via the signals XSW0 and XSW1 that are applied to pin 7 and pin 8 of D2001. These signals are derived from XYSW0 and XYSW1 that come from output stage V8036/V8041 on the digitizer unit A8. Digital mode is on with XSW0 at 0 mA and XSW1 at 1 mA. Analog mode is on with XSW0 at 1 mA and XSW1 at 0 mA.

Gain control is possible via pin 1 of D2001. This is used for trace gain control via signal XTRAGC. Gain control to compensate for CRT tolerances is achieved via pin 14 of D2001. This is controlled via the DAC output signals XCRTGCL and XCRTGCH. Offset control to compensate for CRT tolerances is achieved via pin 15 of D2001. This is controlled via the DAC output signals XCRTOFH and XCRTOFL. Adjustment of the HF response (and linearity) is achieved via signal XHFADJ via pin 17 and 26 of D2001.

The final X-amplifier consists of two identical halves that receive input signals that are in opposite phase. These signals originate from the D2001 outputs pin 24/25 (XDRIL0/XDRIL1) and pin 18/19 (XDRIR0/XDRIR1). The two X-amplifier sections drive respectively the left and right deflection plate of the CRT.

The final X amplifier half that drives the left deflection plate is explained now. Its function is identical to that of the other amplifier half. The balanced input signals XDRIL1 and XDRIL0 are applied to input stage V2101. V2104 is a current source. XDRIL0 is not used and connected to +5 V. In the collector circuit of V2101 are the zener diodes V2102/V2103 that function as level shifters. The emitter followers V2132 and V2111 supply the output stage V2134/V2113 with signal. V2113 functions as an amplifier stage and V2134 mainly as a current source. V2134 receives signal via C2131 and mainly functions as amplifier stage in the fastest sweep speeds. Via R2133/R2134 however some dc drive is also applied to V2134.

The circuit with operational amplifier N2003 is used to measure the output voltage that is applied to the X-deflection plates of the CRT. This measurement is done via high-ohmic resistors R2301 and R2302. The analog output voltage XCAL of N2003 is applied to an ADC incorporated in the microprocessor on unit A3. This enables the microprocessor to exactly measure the horizontal output voltage. This is used for automatic calibration of the horizontal deflection.

Diagram 4

This diagram shows the final intensity (Z) and focusing amplifiers. These amplifiers drive the intensity electrode G1 and the focusing electrode G3 of the CRT. The input circuit is formed by IC D3001.

Input pin 5 and 6 of D3001 receive the Z-pulses that determine intensity during the analog mode. Input pin 9 and 10 receive the Z- pulses ZTXT0 and ZTXT1 from output stage V8027/V8028 on digitizer unit A8. The selection between analog and digital mode is done via the signals ZSW0 and ZSW1 that are applied to pin 7 and 8 of D3001. These signals are coming from output stage V8042/V8033 on the digitizer unit A8. Digital mode is on with ZSWO at 0 mA and ZSW1 at 1 mA. Analog mode is on with ZSW0 at 1 mA and ZSW1 at 0 mA.

The final Z-amplifier and the focusing amplifier are identical halves that receive input signals that are in opposite phase. These signals originate from the D3001 outputs pin 24/25 (ZDRIF1/ZDRIF0) and pin 18/19 (ZDRII0/ZDRII1).

Via V3002 part of the ripple on the negative CRT cathode voltage (ZRIPPLE) is applied to pin 15 of D3001. This compensates for unwanted intensity modulation due to this ripple.
The diodes V3236, V3136, V3237 and V3137 protect D3001 against possible high voltage surges.

V3301 supplies the intensity determining signal INTEN-DA. This signal adjusts the "dark level" of the CRT. V3301 is controlled by DAC N2002 output signal DARK. V3311 supplies signal ASTIG that determines the astigmatism of the CRT. V3311 is controlled by DAC N2002 output signal ASTDR.

The upper amplifier half that is used for the dynamic focus control is explained now. Its function is identical to that of the lower amplifier half that is used for intensity (Z) control. The balanced input signals ZDRIF1 and ZDRIF0 are applied to input stage V3101. V3104 is a current source. ZDRIF0 is not used and connects to +5 V. In the collector circuit of V3101 are the zener diodes V3102/V3103 that function as level shifters. The emitter followers V3132 and V3111 supply the output stage V3134/V3113 with signal. V3113 functions as an amplifier stage and V3134 mainly as a current source. V3134 receives signal via C3131 and mainly functions as amplifier stage for fast input signals. Via R3133/R3134 however some dc drive is also applied to V3134.

The circuit with V3282/V3212 suppresses the light on the screen at power down. V3282 becomes conductive via the fast falling +12 V and the slowly falling charge in C3281.

Diagram 5

In this diagram the circuit is shown that forms an interface between the signals that determine the intensity/focusing and the CRT electrodes G1/G3 that control intensity/focusing. These electrodes, the cathode and filament (heater) of the CRT are at a high negative voltage. This voltage is separated from the other oscilloscope circuits via the 3kV capacitors C4004, C4061, C4036 and C4037.

The intensity is influenced by the output signal INTEN-AA of the Z- amplifier and the signal INTEN-DA. INTEN-AA is determined via the front-panel INTENS TRACE, INTENS TEXT, MTBI and chopper blanking control signals. The HF component in the INTEN-AA signal is applied to G1 of the CRT via C4037. The DC and LF components are applied to the base of V4034. The INTEN-DA signal is applied to the base of V4032 and forms the clamplevel (dark level) of the DC and LF part of INTEN-AA derived from V4034. These two transistors form the inputs of a 150kHz modulator that basically consists of V4031 and V4033. The LF and DC components that are modulated on the 150 kHz carrier signal can pass via buffer stage V4038/V4039 and then via high voltage blocking capacitor C4036. Behind capacitor C4036 demodulation takes place via the diodes V4043 and V4044. This results in the original INTEN-AA signal that is superpositioned on the INTEN-DA voltage that corrects the cut-off voltage of the CRT applied to G1 and via R4051 also to G3. Across R4044 a small negative voltage (compared with the cathode) is developed for G1. This voltage is not big enough to make the CRT screen dark. This means that the signals to darken the screen and to control intensity are applied via C4036 and C4037.

The HF component from the focusing amplifier output signal FOCUS-AA is applied to G3 via C4004 and voltage divider R4008/R4009/C4002/C4003. This assures optimal tracking between focus and intensity. The signal FOCUS-DA is determined via the FOCUS control at the instruments front panel. The signal FOCUS-DA is then mixed with the LF component of FOCUS-AA before its level is adapted to the nominal G3 voltage via transistors V4002/V4003/V4004.

Diagram 6

This diagram shows the RC-branches and regulators N5131 that give the supply voltages for the various circuits. Also the connectors X2501 and X2301 are indicated here. X2301 is the connector where the flat cable leaves for the small unit that incorporates the CRT-socket X2403. The flat cable arrives at the small CRT-socket unit at X2401.

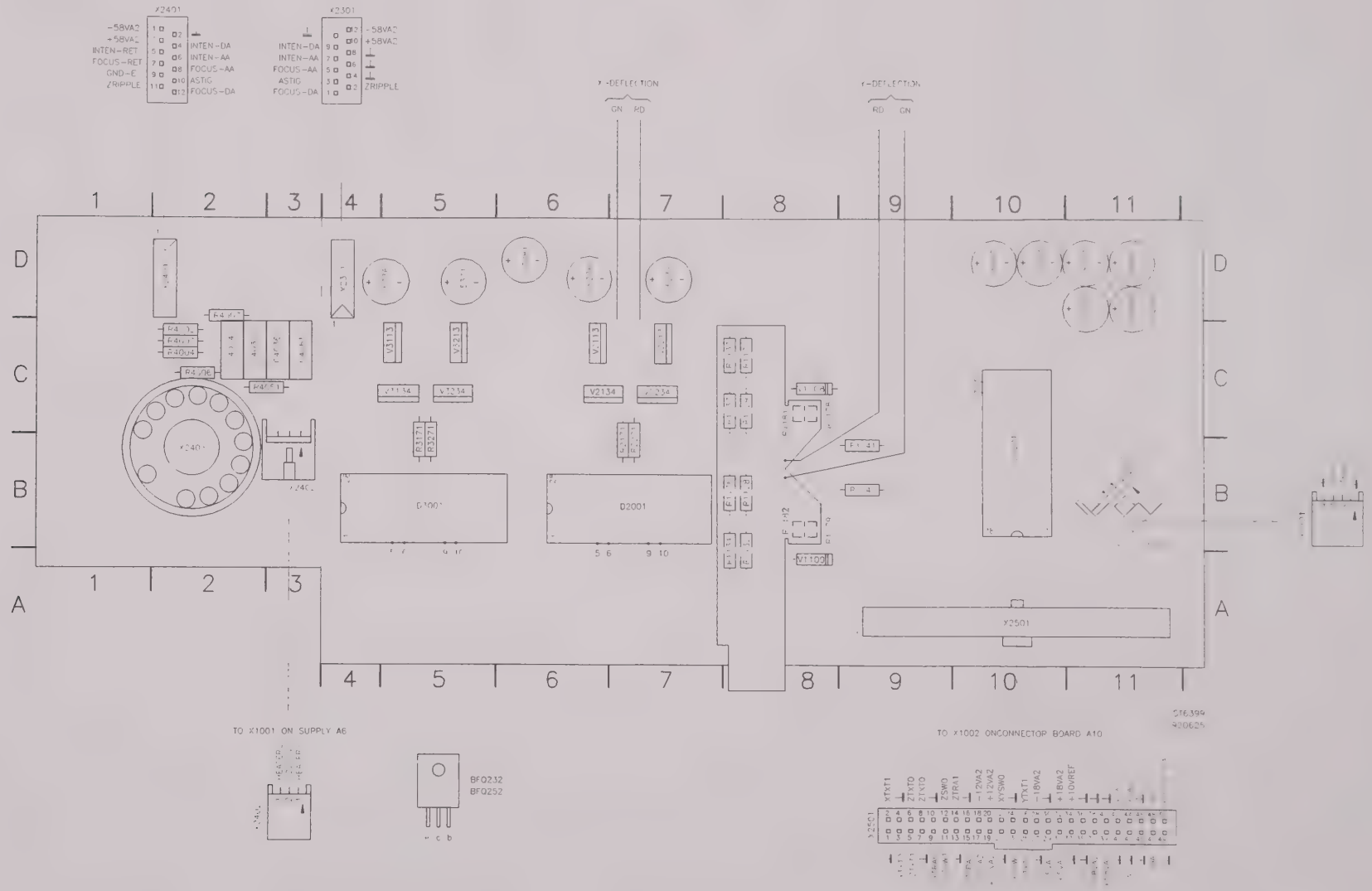
5.2.2 Signal name list A2-200 MHz version

Note: In the signal name list you find the itemnumber of the component that is source or destination. Behind this itemnumber (separated by ":") you find the number of the diagram where the source/destination can be found.

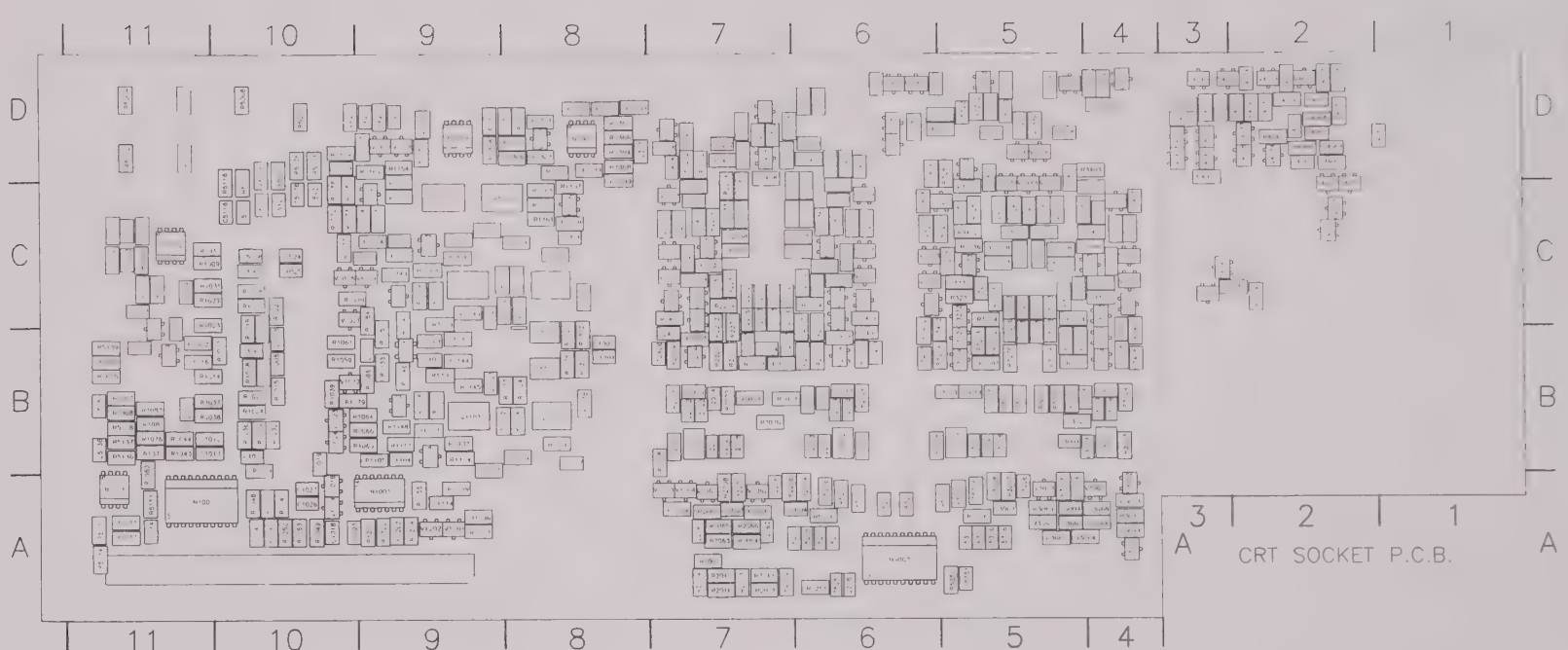
NAME	MEANING	SOURCE	DESTINATION
ASTDR	DRIVER SIGNAL FOR ASTIGMATISM	N2002:03	R3313:04
ASTIG	ASTIGMATISM CONTROL	V3311:04	X2301:06 X2401:05 X2403:05
DARK	DRIVER SIGNAL FOR DC PART INTENS	N2002:03	V3301:04
FOCUS-AA	AC PART FOCUSING SIGNAL	R3161:04	X2301:06 X2401:05 R4008:05
FOCUS-DA	DC PART FOCUSING SIGNAL	X2501:06	X2301:06 X2401:05 C4001:05 R4001:05
G1	INTENSITY GRID 1 OF CRT	C4037:05 R4044:05	X2403:05
G3	FOCUSING GRID 3 OF CRT	C4004:05 R4051:05	X2403:05
HEATER1	FILAMENT SUPPLY F1 OF CRT	X2402:05	X2403:05
HEATER2	FILAMENT SUPPLY F2 OF CRT	X2402:05	X2403:05
INTEN-AA	AC PART OF INTENSITY SIGNAL	R3261:04	X2401:05 C4037:05
INTEN-DA	DC PART OF INTENSITY SIGNAL	V3301:04	X2301:06 X2401:05 V4032:05
SCL	SERIAL CLOCK	X2501:06	J1002:06 J2002:06
SDA	SERIAL DATA	X2501:06	J1001:06 J2001:06
XCAL	AUTOCAL SIGNAL X DEFLECTION	R2313:03	X2501:06
XDRIL0	DRIVE SIGNAL 0 LEFT X AMPLIFIER	D2001:03	R2101:03
XDRIL1	DRIVE SIGNAL 1 LEFT X AMPLIFIER	D2001:03	R2103:03
XDRIR0	DRIVE SIGNAL 0 RIGHT X AMPLIFIER	D2001:03	R2203:03
XDRIR1	DRIVE SIGNAL 1 RIGHT X AMPLIFIER	D2001:03	R2201:03
XHFADJ	HF ADJUSTMENT X AMPLIFIER	N2002:03	R2018:03
XLTXT0	X SHIFT TEXT 0	V2062:03	D2001:03
XLTXT1	X SHIFT TEXT 1	V2061:03	D2001:03
XOUT0	X OUTPUT 0	V2134.03 V2113:03	R2171.03
XOUT1	X OUTPUT 1	V2234:03 V2213:03	R2271:03
XPLATE0	X OUTPUT 0 TO CRT	R2161:03	CRT LEFT PLATE
XPLATE1	X OUTPUT 1 TO CRT	R2261:03	CRT RGHT PLATE

XSCL	SERIAL CLOCK X SECTION	J2002:06	N2002:03
XSDA	SERIAL DATA X SECTION	J2001:06	N2002:03
XSW0	X SWITCH SIGNAL 0 TRACE/TEXT	V1204:01	D2001:03
XSW1	X SWITCH SIGNAL 1 TRACE/TEXT	V1203:01	D2001:03
XYSW0	X/Y SWITCH SIGNAL 0 TRACE/TEXT	X2501:06	R1204:01
XYSW1	X/Y SWITCH SIGNAL 1 TRACE/TEXT	X2501:06	R1201:01
XTRA0	X TRACE 0 SIGNAL	X2501:06	R2004:03
XTRA1	X TRACE 1 SIGNAL	X2501:06	R2006:03
XTXT0	X TEXT 0 SIGNAL	X2501:06	R2063:03
XTXT1	X TEXT 1 SIGNAL	X2501:06	R2064:03
YCAL	AUTOCAL SIGNAL Y DEFLECTION	R1309:02	X2501:06
YFSH	HF SQ WAVE RESPONSE FINAL Y	N1003:01	R1146:02 R1147:02
YPREOUT0	Y PREAMPLIFIER OUT 0	R1061:01	V1101:01
YPREOUT1	Y PREAMPLIFIER OUT 1	R1059:01	V1102:01
YSCL	SERIAL CLOCK Y SECTION	J1002:06	N1001:01
YSDA	SERIAL DATA Y SECTION	J1001:06	N1001:01
YSW0	Y SWITCH SIGNAL 0 TRACE/TEXT	V1202:01	D1001:01
YSW1	Y SWITCH SIGNAL 1 TRACE/TEXT	V1201:01	D1001:01
YTRA0	Y TRACE 0 OUT FROM DELAY LINE	X2101:01	D1001:01
YTRA1	Y TRACE 1 OUT FROM DELAY LINE	X2102:01	D1001:01
YTXT0	Y TEXT 0 SIGNAL	X2501:01	D1001:01
YTXT1	Y TEXT 1 SIGNAL	X2501:01	D1001:01
ZDRIF0	DRIVER SIGNAL 0 FOCUS AMPLIFIER	D3001:04	R3101:04
ZDRIF1	DRIVER SIGNAL 1 FOCUS AMPLIFIER	D3001:04	R3103:04
ZDRII0	DRIVER SIGNAL 0 INTENS AMPLIFIER	D3001:04	R3203:04
ZDRII1	DRIVER SIGNAL 1 INTENS AMPLIFIER	D3001:04	R3201:04
ZLTRA0	Z LEVEL TRACE INTENSITY 0	V3062:04	R3004:04
ZLTRA1	Z LEVEL TRACE INTENSITY 1	V3061:04	R3006:04
ZOUTF	FEEDBACK SIGNAL FOCUS AMPLIFIER	V3113:04	R3171:04
ZOUTI	FEEDBACK SIGNAL INTENSITY AMPL.	V3213:04	R3271:04
ZRIPPLE	RIPPLE ON NEGATIVE HIGH VOLTAGE	C4061:05	V3001:04
ZSW0	Z SWITCH SIGNAL 0 TEXT/TRACE	X2501:06	D3001:04
ZSW1	Z SWITCH SIGNAL 1 TEXT/TRACE	X2501:06	D3001:04
ZTRA0	Z TRACE INTENSITY 0	X2501:06	R3063:04
ZTRA1	Z TRACE INTENSITY 1	X2501:06	R3064:04
ZTXT0	Z TEXT 0 SIGNAL	X2501:06	R3007:04
ZTXT1	Z TEXT 1 SIGNAL	X2501:06	R3008:04

5.2.3 Unit lay-outs A2-200 MHz version



Lay-out 1 - Large component side of XYZ amplifier unit A2-200 MHz



Lay-out 2 - Small component side of XYZ amplifier unit A2-200 MHz

5.2.4 Location list A2-200 MHz version

'-L' means that the component is located on the side with the large components. Otherwise the component is located on the side with small components.

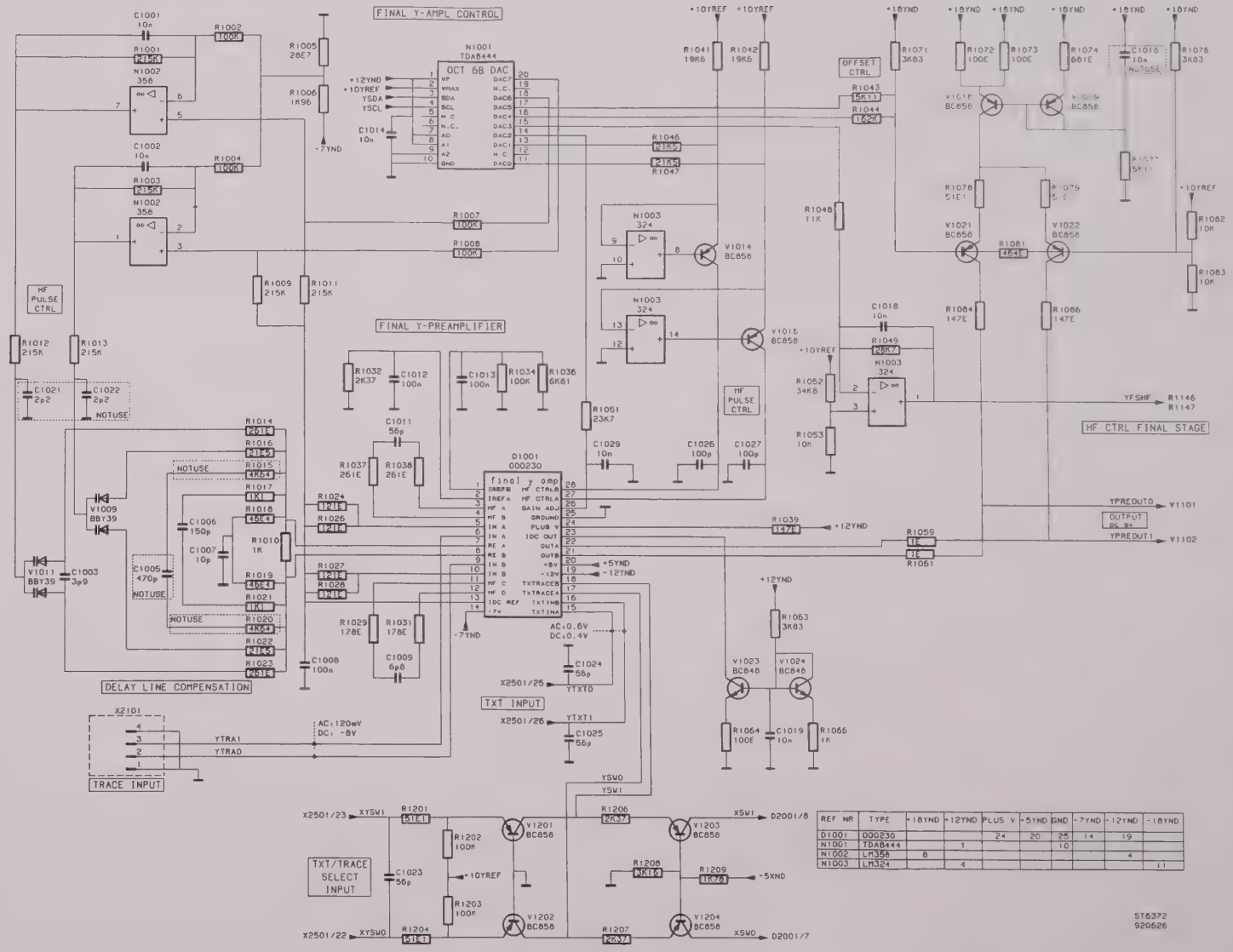
C1001 C11
C1002 C11
C1003 B11
C1005 B10
C1006 B10
C1007 B10
C1008 C10
C1009 C11
C1011 B11
C1012 B11
C1013 B11
C1014 A11
C1016 C10
C1018 A10
C1019 B10
C1021 C11
C1022 B11
C1023 A10
C1024 C10
C1025 C10
C1026 A10
C1027 A10
C1029 B10
C1101 B9
C1102 B9
C1103 C9
C1104 B9
C1106 C8
C1107 B8
C1108 C9
C1109 B9
C1110 B9
C1111 D10
C1112 C9
C1113 B9
C1114 A9
C1121 C9
C1122 B9
C1123 D9
C1301 B8
C1302 B8
C2001 B6
C2002 B6
C2003 B6
C2004 A7
C2006 A7
C2007 A7
C2008 B7
C2009 B7
C2011 B7
C2012 B7
C2013 B7
C2014 B7
C2016 B6
C2017 B6
C2018 B6
C2019 B6
C2021 B7
C2022 B7
C2061 A7
C2062 A7
C2081 A6
C2103 C6
C2131 C6
C2132 C7
C2133 C6
C2151 C6
C2171 C7
C2172 C7
C2173 C7
C2174 B7
C2176 C7
C2177 B7
C2203 C7
C2231 C7
C2232 C7
C2233 C7
C2251 C7
C2271 C7
C2272 C7
C2273 C7
C2276 C7
C2277 B7
C2301 D7
C2302 D7
C2303 D7
C2401 B6
C2402 B7
C2403 D6
C2404 D7
C2406 B7
C2407 B6
C2418 D7
C3001 B5
C3002 B4
C3003 B5
C3004 A5
C3006 A5
C3007 A5
C3008 B5
C3009 B5
C3011 B5
C3013 B6
C3014 B5
C3016 B5
C3017 B4
C3018 B4
C3019 B4
C3021 B5
C3061 A5
C3103 C4
C3131 C5
C3132 C5
C3133 C5
C3151 C4
C3171 C5
C3172 C5
C3173 B5
C3176 B5
C3203 C5
C3231 C5
C3232 C5
C3233 C5
C3251 C5
C3271 C5
C3272 C5
C3273 B5
C3276 B5
C3281 D6-L
C3401 B4
C3402 B6
C3403 C4
C3404 C6
C3406 B4
C3407 B6
C3418 C5
C4001 D2
C4002 D2
C4003 D2
C4004 C2-L
C4031 D2
C4032 D3
C4033 D3
C4034 D2
C4036 C3-L
C4037 C2-L
C4051 D2
C4061 C3-L
C4062 D2
C5001 D11-L
C5002 D11-L
C5003 D11-L
C5004 D11-L
C5007 D10-L
C5008 D10-L
C5011 D6
C5012 D6
C5101 C10
C5106 C10
C5111 C10
C5116 C10
C5121 C10
C5126 C10
C5136 B11
C5138 C10
C5151 B11
C5201 A6
C5206 A6
C5211 A6
C5216 A7
C5221 A6
C5226 D7
C5231 D7-L
C5232 D7
C5236 D6-L
C5238 D6
C5251 A6
C5301 A5
C5306 A5
C5311 A5
C5316 A5
C5321 A6
C5322 D5
C5326 D5
C5331 D5-L
C5332 D5
C5336 D5-L
C5338 D5
C5351 A5
C5411 D9
C5416 D9
D1001 B10-L
D2001 B7-L
D3001 B5-L
L1101 B8
L1102 B8
N1001 A11
N1002 C11
N1003 A9
N1004 D9

N2002 A6
N2003 D8
N5131 A11
R1001 C11
R1002 C11
R1003 C11
R1004 C11
R1005 B11
R1006 B11
R1007 B11
R1008 B11
R1009 C11
R1010 B11
R1011 C11
R1012 C11
R1013 C11
R1014 B11
R1015 B10
R1016 B11
R1017 B10
R1018 B10
R1019 B10
R1020 C10
R1021 B10
R1022 B11
R1023 C11
R1024 B10
R1026 B10
R1027 C10
R1028 C10
R1029 C11
R1031 C11
R1032 B10
R1034 B10
R1036 B10
R1037 B11
R1038 B11
R1039 B10
R1041 A10
R1042 A10
R1043 B11
R1044 B11
R1046 A10
R1047 A10
R1048 A10
R1049 A10
R1051 B10
R1052 A10
R1053 A10
R1059 B10
R1061 B10
R1063 B10
R1064 B10
R1066 B10
R1071 B11
R1072 C10
R1073 C10
R1074 C10
R1076 B11
R1077 C10
R1078 C10
R1079 B10
R1081 B11
R1082 A11
R1083 B11
R1084 C9
R1086 B9
R1101 C9
R1102 B9
R1103 C9
R1104 C9
R1105 B9
R1106 C9
R1107 B9
R1108 B9
R1109 C9
R1111 C9
R1112 B9
R1113 C9
R1114 B9
R1116 B9
R1117 C9
R1118 C8
R1121 C8
R1122 B8
R1123 C8
R1124 B8
R1126 B8
R1127 B8
R1128 B8-L
R1129 C8-L
R1131 C8-L
R1132 A8-L
R1133 C8-L
R1134 A8-L
R1136 B8-L
R1137 C8-L
R1138 B8
R1139 C8
R1140 C9
R1141 C9-L
R1142 B9-L
R1143 B9
R1144 B9
R1145 B9
R1146 B9
R1147 B9
R1148 B9
R1149 C9
R1150 B9
R1151 C10
R1152 C9
R1153 D9
R1154 D9
R1155 B9
R1156 C10
R1157 D8
R1158 A9
R1159 A9
R1161 C8
R1162 C8
R1163 C8
R1164 D10
R1166 D9
R1167 B9
R1168 C9
R1169 D10
R1170 D8
R1171 C8
R1172 B9
R1173 C9
R1174 B8
R1176 C9
R1177 B9
R1178 C8-L
R1179 B8-L
R1181 C8-L
R1182 B8-L
R1201 A9
R1202 A9
R1203 A9
R1204 A9
R1206 A9
R1207 A9
R1208 B7
R1209 A7
R1301 B8
R1302 B8
R1303 D8
R1304 D8
R1306 D9
R1307 D9
R1308 D9
R1309 D9
R1311 D9
R1312 D8
R1313 D9
R2001 A7
R2002 A7
R2003 B6
R2004 A6
R2006 A7
R2007 A7
R2008 A7
R2009 B7
R2011 A7
R2012 A7
R2013 A7
R2014 A7
R2015 B7
R2016 A7
R2017 A7
R2018 B7
R2020 B7
R2021 B7
R2023 B6
R2024 B6
R2026 B7
R2063 A7
R2064 A7
R2065 A7
R2066 A7
R2067 A7
R2068 A7
R2101 B6
R2102 B6
R2103 B6
R2104 B6
R2107 C6
R2111 C6
R2112 D6
R2113 C6
R2131 C6
R2132 C6
R2133 C6
R2134 C6
R2136 C6
R2137 C7
R2138 C7
R2151 D6
R2161 C7
R2171 B7-L
R2172 B7
R2176 B6
R2177 B6
R2201 B7
R2202 B7
R2203 B7
R2204 B7
R2207 C7
R2211 C7
R2212 D7
R2214 C7
R2231 C7
R2232 C7
R2233 C7
R2234 C7
R2236 C7
R2237 C7
R2238 C7
R2251 D7
R2261 C7
R2271 B7-L
R2272 B7

R2276 B7
R2277 B7
R2301 D7
R2302 D7
R2303 D8
R2304 D8
R2306 D8
R2307 D8
R2308 D8
R2309 D8
R2311 D8
R2312 D8
R2313 D8
R2401 C6
R2402 C7
R2403 D6
R2404 D7
R2406 D7
R2411 C6
R2412 C7
R2416 D6
R2417 D7
R3001 B5
R3002 B5
R3003 B4
R3004 A5
R3006 A5
R3007 A5
R3008 A5
R3009 B6
R3011 B5
R3012 B5
R3013 A4
R3014 A4
R3015 A4
R3018 B5
R3021 B5
R3024 B4
R3026 B5
R3063 A5
R3064 A5
R3066 A5
R3067 A5
R3068 A5
R3069 A5
R3101 B5
R3102 B5
R3103 B5
R3104 B4
R3107 C4
R3111 C4
R3112 C5
R3113 C5
R3131 C4
R3132 C4
R3133 C5
R3134 C5
R3136 C5
R3137 C5
R3138 C5
R3151 C5
R3161 C5
R3171 B5-L
R3176 B5
R3201 B5
R3202 B5
R3203 B5
R3204 B6
R3207 C6
R3211 C6
R3212 C5
R3213 C5
R3231 C5
R3232 C5
R3233 C5
R3234 C5
R3236 C5
R3237 C5
R3238 C5
R3251 C5
R3261 C5
R3271 B5-L
R3276 B5
R3281 D6
R3282 D5
R3301 D4
R3302 D4
R3311 D5
R3312 D5
R3313 D4
R3314 D5
R3316 D5
R3401 B4
R3402 B6
R3403 D5
R3404 D6
R3411 C5
R3412 C5
R3416 D5
R3417 D5
R4001 D2
R4002 C2-L
R4003 C2-L
R4004 C2-L
R4006 C2-L
R4007 D2-L
R4008 D2
R4009 D2
R4031 D2
R4032 D2
R4033 D2
R4034 D2
R4036 D2
R4037 D3
R4038 D2
R4039 D2
R4040 D3
R4041 D2
R4042 D2
R4043 D3
R4044 C2
R4045 C3
R4051 C2-L
R5001 D11
R5002 D11
R5003 D11
R5004 D11
R5007 D10
R5008 D10
R5101 D10
R5106 D10
R5111 C10
R5116 C10
R5121 D10
R5126 D10
R5131 A11
R5132 A11
R5133 A11
R5134 A11
R5136 B11
R5137 B11
R5138 B11
R5139 B11
R5151 A11
R5201 A6
R5206 A6
R5211 A6
R5216 A6
R5221 D6
R5226 D6
R5231 D7
R5236 D7
R5251 A6
R5301 A5
R5306 A5
R5311 A6
R5316 A5
R5321 D6
R5326 D6
R5331 D5
R5336 D5
R5351 A5
R5411 D10
R5416 D9
V1009 B11
V1011 B11
V1014 A10
V1016 A10
V1018 C10
V1019 C10
V1021 C10
V1022 B10
V1023 B10
V1024 B10
V1101 C9
V1102 B9
V1103 C9
V1104 B9
V1106 C9
V1107 B9
V1108 C8-L
V1109 B8-L
V1111 C8
V1112 B8
V1113 B9
V1121 C9
V1122 C9
V1123 C9
V1126 C8
V1127 D9
V1128 D9
V1201 A9
V1202 A9
V1203 A7
V1204 A7
V1301 D8
V2019 B6
V2061 A7
V2062 A7
V2101 C6
V2102 C6
V2103 C6
V2104 B6
V2111 C6
V2113 C6-L
V2131 C6
V2132 C6
V2133 C6
V2134 C7-L
V2201 C7
V2202 C7
V2203 C7
V2204 B7
V2211 C7
V2213 C7-L
V2231 C7
V2232 C7
V2233 C7
V2234 C7-L
V2301 D7
V2403 D7
V2418 D7
V3001 A4
V3002 A4

V3061 A5
V3062 A5
V3101 B4
V3102 C4
V3103 C4
V3104 B4
V3111 C4
V3113 C5-L
V3131 C4
V3132 C4
V3133 C4
V3134 C5-L
V3136 D5
V3137 D5
V3201 B5
V3202 C6
V3203 C6
V3204 B5
V3211 C6
V3212 D5
V3213 C5-L
V3231 C6
V3232 C5
V3233 C5
V3234 C5-L
V3236 D5
V3237 D5
V3281 D6
V3282 D6
V3301 D4
V3311 D5
V3312 D5
V3418 D5
V4001 D2
V4002 D2
V4003 C2
V4004 C2
V4031 D2
V4032 D3
V4033 D2
V4034 D2
V4036 D2
V4037 D2
V4038 D3
V4039 D3
V4040 D3
V4041 D3
V4042 D3
V4043 C3
V4044 C3
V5001 D6
V5002 D6
X2101 A11-L
X2301 D4-L
X2401 D2-L
X2402 B3-L
X2403 B3-L
X2501 A10-L

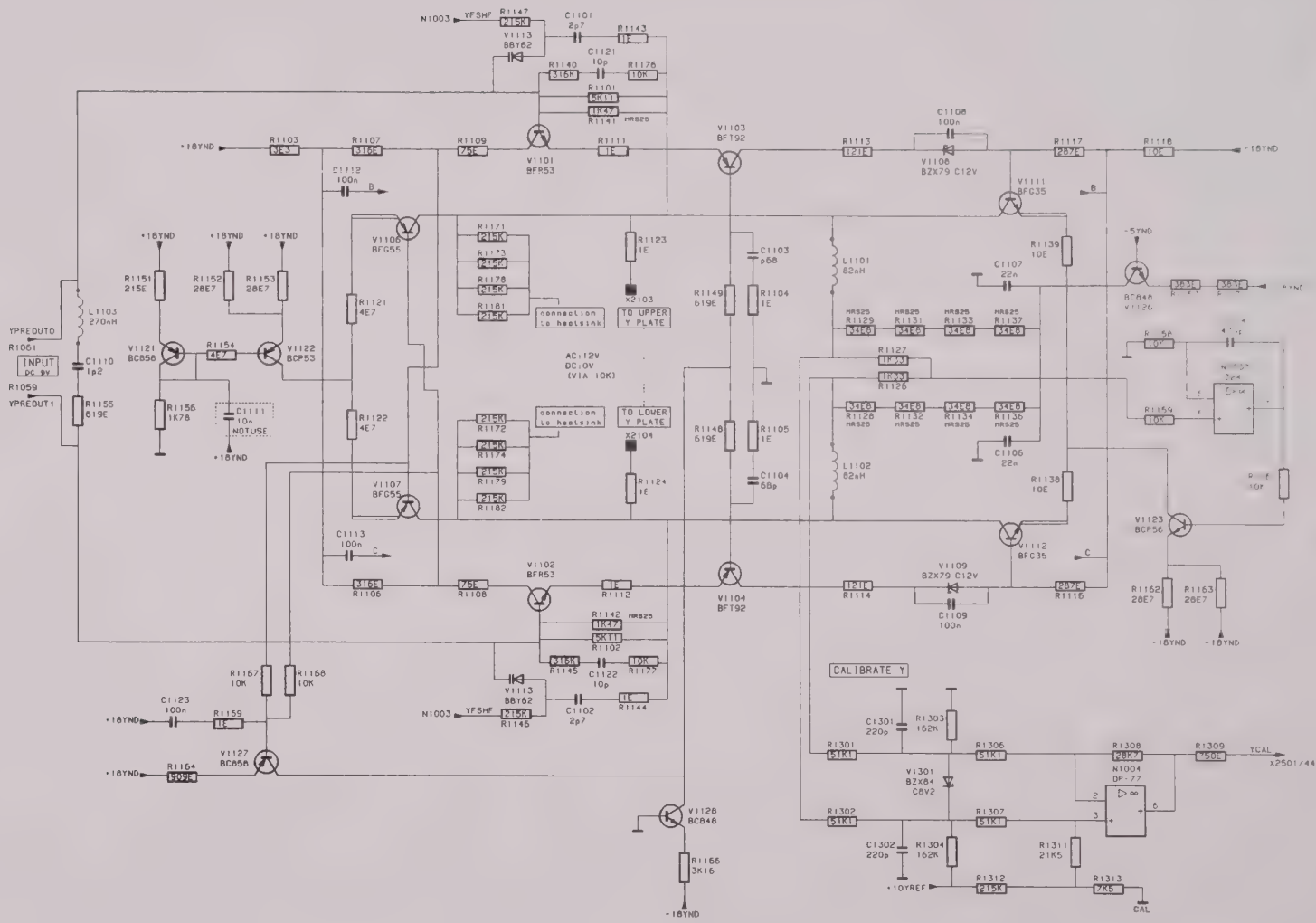
5.2.5 Circuit diagramsA2-200 MHz version



REF NR	TYPE	+18YND	+12YND	PLUS V	+5YND	GND	-7YND	-12YND	-18YND
D1001	000230			24	20	25	14	19	
N1001	TDA8444		1			10			
N1002	LM358	8						4	
N1003	LM324		4						11

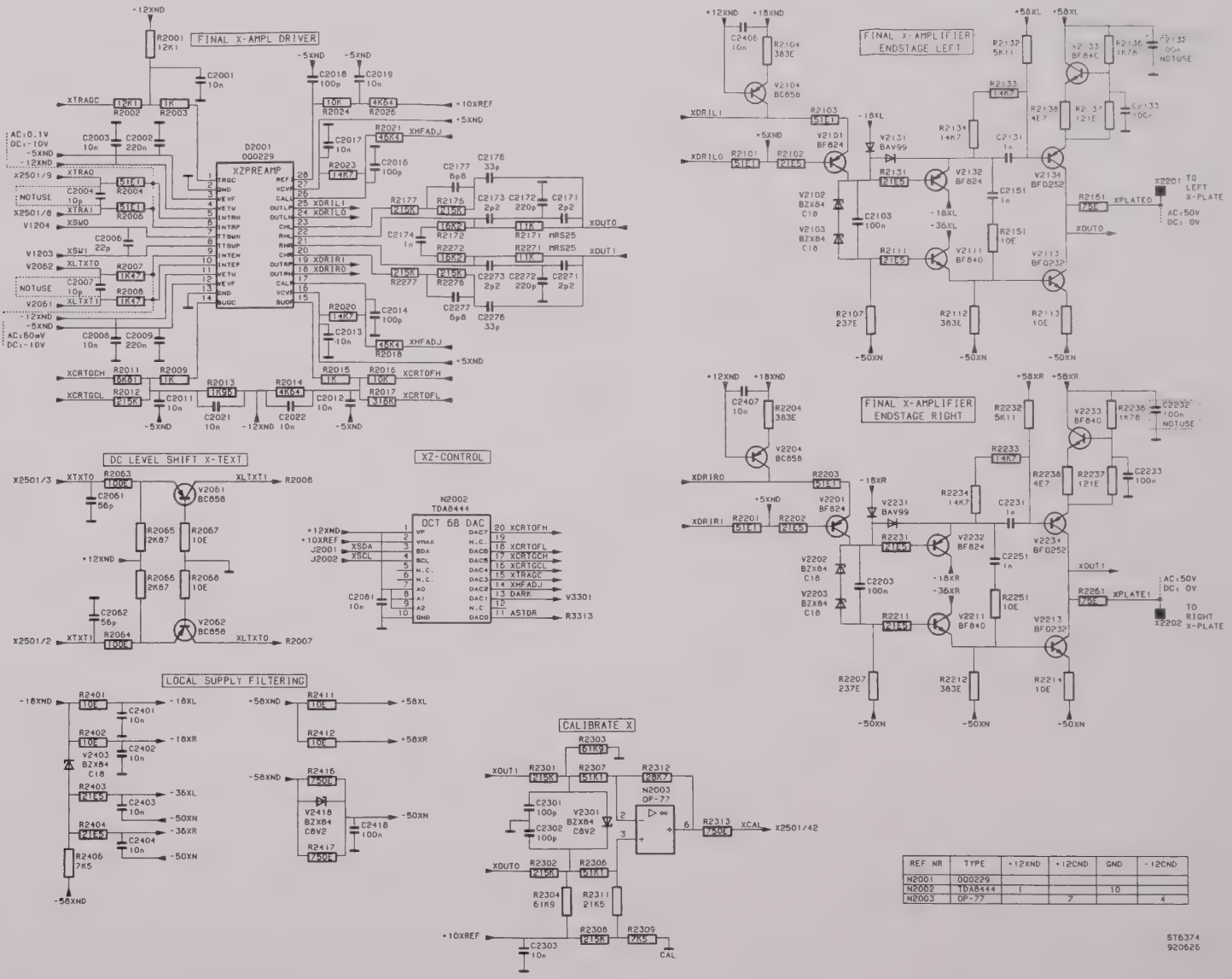
ST6372
920626

A2 (200 MHz) - Diagram 1 ; Final Y preamplifier and control

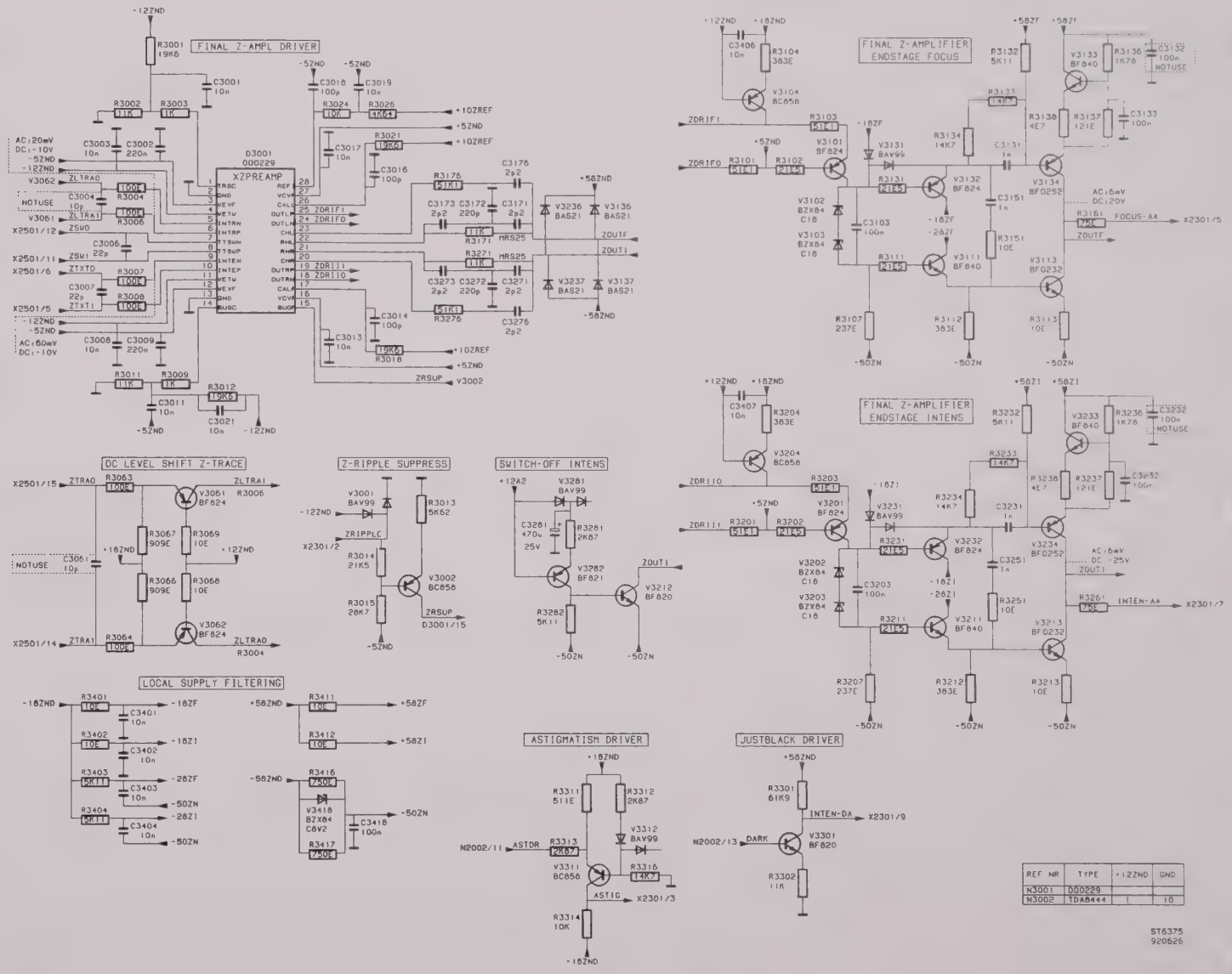


REF NR	TYPE	+12VND	+12CND	GND	-12CND	-18VND
N1003	LM324	4				11
N1004	OP-77		7		4	

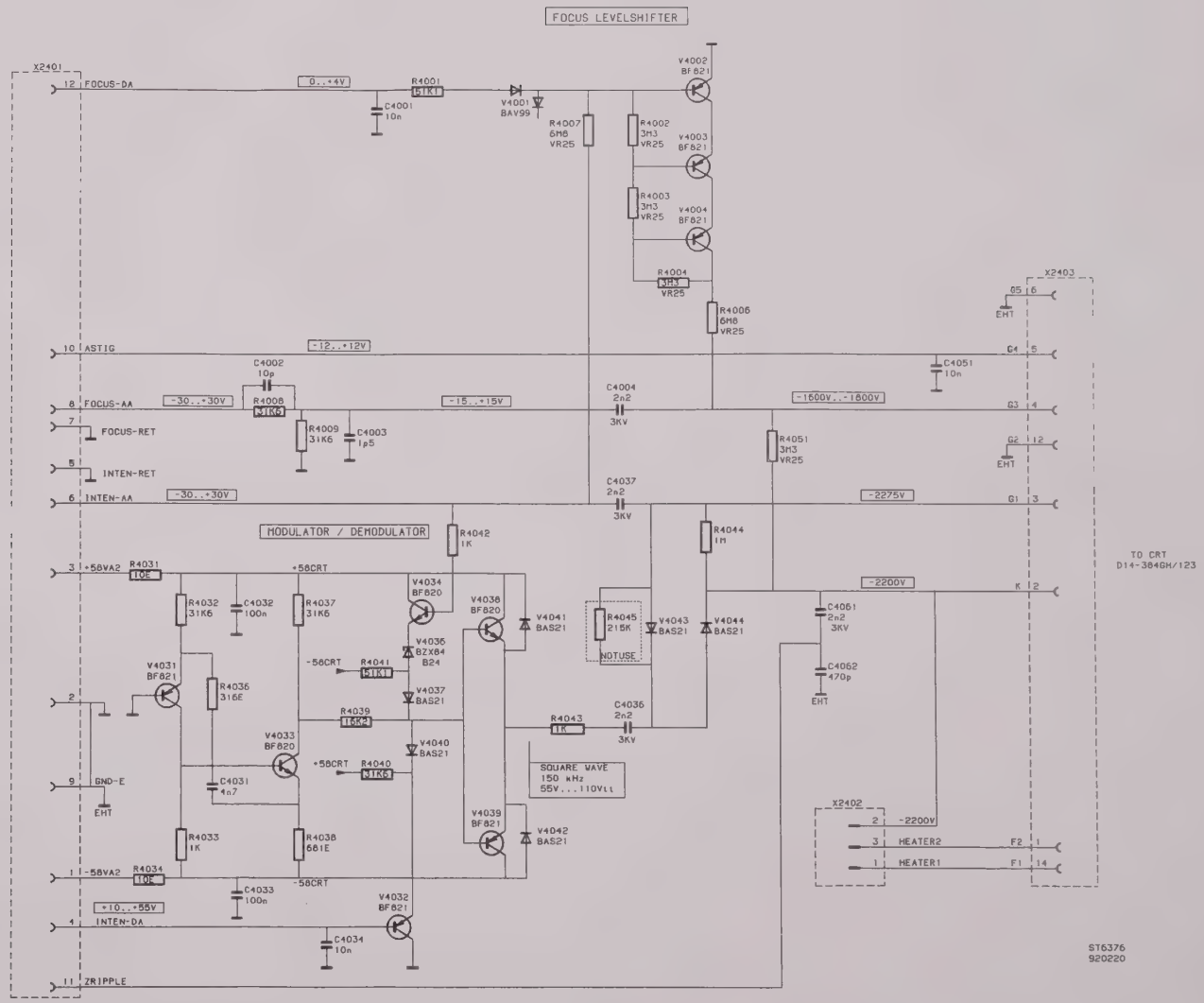
A2 (200 MHz) - Diagram 2 ; Final Y output stage



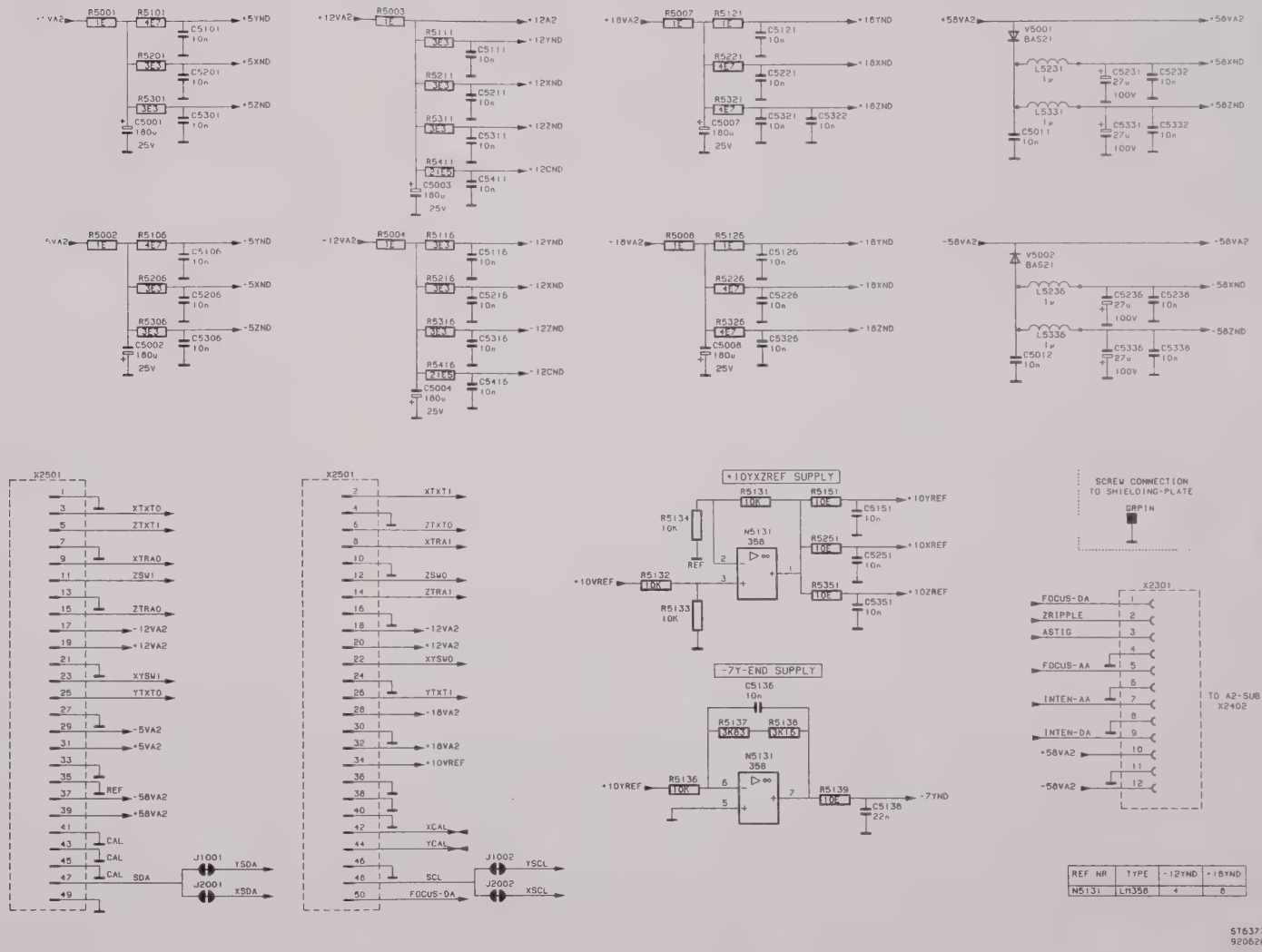
A2 (200 MHz) - Diagram 3 ; Final X amplifier and control



A2 (200 MHz) - Diagram 4 ; Final Z amplifier



A2 (200 MHz) - Diagram 5 ; Modulator/demodulator and focus control



REF NR	TYPE	-12YND	+18YND
N5131	LM358	4	8

ST6377
920626

A2 (200 MHz) - Diagram 6 ; Supply circuits

5.2.6 Parts list A2-200 MHz version

CAPACITORS

Item	Description		Ordering code
C 1001	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1002	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1003	CAP.CHIP	63V 10% 3.9pF	5322 126 10185
C 1006	CAP.CHIP	63V 5% 150pF	5322 122 33538
C 1007	CAP.CERAMIC	63V 5% 10pF	5322 122 32448
C 1008	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1009	CAP.CERAMIC	63V 5% 6.8pF	5322 122 32269
C 1011	CAP.CHIP	63V 5% 56pF	5322 122 32661
C 1012	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1013	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1014	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1018	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1019	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1023	CAP.CHIP	63V 5% 56pF	5322 122 32661
C 1024	CAP.CHIP	63V 5% 56pF	5322 122 32661
C 1025	CAP.CHIP	63V 5% 56pF	5322 122 32661
C 1026	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 1027	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 1029	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1101	CAP.CERAMIC	63V 0.25pF 2.7pF	5322 122 31873
C 1102	CAP.CERAMIC	63V 0.25pF 2.7pF	5322 122 31873
C 1106	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 1107	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 1108	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1109	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1110	CAP.CHIP	63V 0.25pF 1.2pF	5322 122 33537
C 1112	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1113	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1114	CAP.CHIP	63V 5% 470pF	5322 122 32268
C 1121	CAP.CERAMIC	63V 5% 10pF	5322 122 32448
C 1122	CAP.CERAMIC	63V 5% 10pF	5322 122 32448
C 1123	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1301	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 1302	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 2001	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2002	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 2003	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2006	CAP.CHIP	63V 5% 22pF	5322 122 32658
C 2008	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2009	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 2011	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2012	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2013	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2014	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 2016	CAP.CHIP	63V 5% 100pF	5322 122 32531

Item	Description		Ordering code
C 2017	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2018	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 2019	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2021	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2022	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2061	CAP.CHIP	63V 5% 56pF	5322 122 32661
C 2062	CAP.CHIP	63V 5% 56pF	5322 122 32661
C 2081	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2103	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 2131	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 2133	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 2151	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 2171	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 2172	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 2173	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 2174	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 2176	CAP.CHIP	63V 5% 33pF	5322 122 32659
C 2177	CAP.CHIP	63V 0.5pF 6.8pF	5322 122 32269
C 2203	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 2231	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 2233	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 2251	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 2271	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 2272	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 2273	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 2276	CAP.CHIP	63V 5% 33pF	5322 122 32659
C 2277	CAP.CHIP	63V 0.5pF 6.8pF	5322 122 32269
C 2301	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 2302	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 2303	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2401	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2402	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2403	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2404	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2406	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2407	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2418	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3001	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3002	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 3003	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3006	CAP.CHIP	63V 5% 22pF	5322 122 32658
C 3007	CAP.CHIP	63V 5% 22pF	5322 122 32658
C 3008	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3009	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 3011	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3013	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3014	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 3016	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 3017	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3018	CAP.CHIP	63V 5% 100pF	5322 122 32531

Item	Description		Ordering code
C 3019	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3021	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3103	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3131	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 3133	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3151	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 3171	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 3172	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 3173	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 3176	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 3203	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3231	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 3233	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3251	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 3271	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 3272	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 3273	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 3276	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 3281	CAP.FOIL	25V 20% 470µF	5322 121 43885
C 3401	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3402	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3403	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3404	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3406	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3407	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3418	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 4001	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4002	CAP.CHIP	63V 5% 10pF	5322 122 32448
C 4003	CAP.CHIP	63V 0.25pF 1.5pF	5322 126 10225
C 4004	CAP.	-10+10% 2.2nF	5322 122 33851
C 4031	CAP.CHIP	63V 10% 4.7nF	5322 126 10223
C 4032	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 4033	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 4034	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4036	CAP.	-10+10% 2.2nF	5322 122 33851
C 4037	CAP.	-10+10% 2.2nF	5322 122 33851
C 4051	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4061	CAP.	-10+10% 2.2nF	5322 122 33851
C 4062	CAP.CHIP	63V 5% 470pF	5322 122 32268
C 5001	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 5002	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 5003	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 5004	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 5007	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 5008	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 5011	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5012	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5101	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5106	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5111	CAP.CHIP	63V 10% 10nF	5322 122 34098

Item	Description		Ordering code
C 5116	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5121	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5126	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5136	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5138	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 5151	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5201	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5206	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5211	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5216	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5221	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5226	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5231	CAP.ELECTROLYT.	100V 20% 27µF	5322 124 42193
C 5232	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5236	CAP.ELECTROLYT.	100V 20% 27µF	5322 124 42193
C 5238	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5251	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5301	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5306	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5311	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5316	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5321	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5322	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5326	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5331	CAP.ELECTROLYT.	100V 20% 27µF	5322 124 42193
C 5332	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5336	CAP.ELECTROLYT.	100V 20% 27µF	5322 124 42193
C 5338	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5351	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5411	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5416	CAP.CHIP	63V 10% 10nF	5322 122 34098

COILS

L 1101	COIL	082µH 5% TDK	5322 157 63382
L 1102	COIL	082µH 5% TDK	5322 157 63382
L 5231	COIL	1µH 5%	5322 157 63648
L5236	COIL	1µH 5%	5322 157 63648
L5331	COIL	1µH 5%	5322 157 63648
L5336	COIL	1µH 5%	5322 157 63648

INTEGRATED CIRCUITS

D 1001	INTEGR.CIRCUIT	OQ0230 FINAL Y	5322 209 12467
D 2001	INTEGR.CIRCUIT	OQ0229 FINAL X-Z	5322 209 12459
D 3001	INTEGR.CIRCUIT	OQ0229 FINAL X-Z	5322 209 12459
N 1001	INTEGR.CIRCUIT	TDA8444AT/N2 PEL	5322 209 30233
N 1002	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175

Item	Description		Ordering code
N 1003	INTEGR.CIRCUIT	LM324M NSC	5322 209 61473
N 1004	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N 2002	INTEGR.CIRCUIT	TDA8444AT/N2 PEL	5322 209 30233
N 2003	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N 5131	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175

RESISTORS

R 1001	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1002	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1003	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1004	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1005	RES.CHIP	RMC1/8 1% 28E7	5322 111 92015
R 1006	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 1007	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1008	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1009	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1010	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1011	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1012	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1013	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1014	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 1016	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 1017	RES.CHIP	RC-02H 1% 1K1	4822 051 51102
R 1018	RES.MET.GLAZED	RMC1/8 1% 46E4	5322 116 82896
R 1019	RES.MET.GLAZED	RMC1/8 1% 46E4	5322 116 82896
R 1021	RES.CHIP	RC-02H 1% 1K1	4822 051 51102
R 1022	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 1023	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 1024	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 1026	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 1027	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 1028	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 1029	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 1031	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 1032	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1034	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1036	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 1037	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 1038	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 1039	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 1041	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 1042	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 1043	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1044	RES.CHIP	RC-02H 1% 162K	4822 051 51624
R 1046	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1047	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1048	RES.CHIP	RC-02H 1% 11K	4822 051 51103

Item	Description		Ordering code
R 1049	RES.CHIP	RC-02H 1% 28K7	4822 051 52873
R 1051	RES.CHIP	RC-02H 1% 23K7	4822 051 52373
R 1052	RES.CHIP	RC-02H 1% 34K8	4822 051 53483
R 1053	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1059	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1061	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1063	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 1064	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1066	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1071	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 1072	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1073	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1074	RES.CHIP	RC-02H 1% 681E	4822 051 56811
R 1076	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1077	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1078	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1079	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1081	RES.CHIP	RC-02H 1% 464E	4822 051 54641
R 1082	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1083	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1084	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 1086	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 1101	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1102	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1103	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 1104	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1105	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1106	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 1107	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 1108	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 1109	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 1111	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1112	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1113	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 1114	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R1116	RES.CHIP	RC-02H 1% 287E	4822 051 52871
R1117	RES.CHIP	RC-02H 1% 287E	4822 051 52871
R 1118	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1121	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 1122	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 1123	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1124	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1126	RES.CHIP	RC-02H 1% 1K33	4822 051 51332
R 1127	RES.CHIP	RC-02H 1% 1K33	4822 051 51332
R 1128	RES.METAL FILM	MRS25 1% 34E8	4822 050 23489
R 1129	RES.METAL FILM	MRS25 1% 34E8	4822 050 23489
R 1131	RES.METAL FILM	MRS25 1% 34E8	4822 050 23489
R 1132	RES.METAL FILM	MRS25 1% 34E8	4822 050 23489
R 1133	RES.METAL FILM	MRS25 1% 34E8	4822 050 23489
R 1134	RES.METAL FILM	MRS25 1% 34E8	4822 050 23489

Item	Description		Ordering code
R 1136	RES.METAL FILM	MRS25 1% 34E8	4822 050 23489
R 1137	RES.METAL FILM	MRS25 1% 34E8	4822 050 23489
R 1138	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1139	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1140	RES.CHIP	RC-02H 1% 316K	4822 051 53164
R 1141	RES.METAL FILM	MRS25 1% 1K47	4822 050 21472
R 1142	RES.METAL FILM	MRS25 1% 1K47	4822 050 21472
R 1143	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1144	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1145	RES.CHIP	RC-02H 1% 316K	4822 051 53164
R 1146	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1147	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1148	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 1149	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 1151	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 1152	RES.CHIP	RMC1/8 1% 28E7	5322 111 92015
R 1153	RES.CHIP	RMC1/8 1% 28E7	5322 111 92015
R 1154	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 1155	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 1156	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 1157	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 1158	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1159	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1161	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1162	RES.CHIP	RMC1/8 1% 28E7	5322 111 92015
R 1163	RES.CHIP	RMC1/8 1% 28E7	5322 111 92015
R 1164	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 1166	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 1167	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1168	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1169	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1170	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 1171	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1172	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1173	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1174	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1176	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1177	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1178	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1179	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1181	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1182	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1201	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1202	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1203	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1204	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1206	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1207	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1208	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 1209	RES.CHIP	RC-02H 1% 1K78	4822 051 51782

Item	Description		Ordering code
R 1301	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 1302	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 1303	RES.CHIP	RC-02H 1% 162K	4822 051 51624
R 1304	RES.CHIP	RC-02H 1% 162K	4822 051 51624
R 1306	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 1307	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 1308	RES.CHIP	RC-02H 1% 28K7	4822 051 52873
R 1309	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 1311	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1312	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1313	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 2001	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 2002	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 2003	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 2004	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2006	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2007	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 2008	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 2009	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 2011	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 2012	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2013	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 2014	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 2015	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 2016	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2017	RES.CHIP	RC-02H 1% 316K	4822 051 53164
R 2018	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 2020	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 2021	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 2023	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 2024	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2026	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 2063	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 2064	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 2065	RES.CHIP	RC-02H 1% 2K87	4822 051 52872
R 2066	RES.CHIP	RC-02H 1% 2K87	4822 051 52872
R 2067	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2068	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2101	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2102	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2103	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2104	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 2107	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 2111	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2112	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 2113	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2131	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2132	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 2133	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 2134	RES.CHIP	RC-02H 1% 14K7	4822 051 51473

Item	Description		Ordering code
R 2136	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 2137	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 2138	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 2151	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2161	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 2171	RES.METAL FILM	MRS25 1% 11K	4822 050 21103
R 2172	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 2176	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2177	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2201	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2202	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2203	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2204	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 2207	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 2211	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2212	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 2214	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2231	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2232	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 2233	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 2234	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 2236	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 2237	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 2238	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 2251	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2261	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 2271	RES.METAL FILM	MRS25 1% 11K	4822 050 21103
R 2272	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 2276	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2277	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2301	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2302	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2303	RES.CHIP	RC-02H 1% 61K9	4822 051 56193
R 2304	RES.CHIP	RC-02H 1% 61K9	4822 051 56193
R 2306	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 2307	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 2308	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2309	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 2311	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 2312	RES.CHIP	RC-02H 1% 28K7	4822 051 52873
R 2313	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 2401	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2402	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2403	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2404	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2406	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 2411	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2412	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2416	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 2417	RES.CHIP	RC-02H 1% 750E	4822 051 57501

Item	Description		Ordering code
R 3001	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 3002	RES.CHIP	RC-02H 1% 11K	4822 051 51103
R 3003	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 3004	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3006	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3007	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3008	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3009	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 3011	RES.CHIP	RC-02H 1% 11K	4822 051 51103
R 3012	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 3013	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 3014	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 3015	RES.CHIP	RC-02H 1% 28K7	4822 051 52873
R 3018	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 3021	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 3024	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3026	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 3063	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3064	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3066	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 3067	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 3068	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3069	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3101	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3102	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3103	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3104	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 3107	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 3111	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3112	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 3113	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3131	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3132	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 3133	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 3134	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 3136	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 3137	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 3138	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 3151	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3161	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 3171	RES.METAL FILM	MRS25 1% 11K	4822 050 21103
R 3176	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 3201	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3202	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3203	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3204	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 3207	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 3211	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3212	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 3213	RES.CHIP	RMC1/8 1% 10E	4822 111 91885

Item	Description		Ordering code
R 3231	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3232	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 3233	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 3234	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 3236	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 3237	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 3238	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 3251	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3261	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 3271	RES.METAL FILM	MRS25 1% 11K	4822 050 21103
R 3276	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 3281	RES.CHIP	RC-02H 1% 2K87	4822 051 52872
R 3282	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 3301	RES.CHIP	RC-02H 1% 61K9	4822 051 56193
R 3302	RES.CHIP	RC-02H 1% 11K	4822 051 51103
R 3311	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 3312	RES.CHIP	RC-02H 1% 2K87	4822 051 52872
R 3313	RES.CHIP	RC-02H 1% 2K87	4822 051 52872
R 3314	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3316	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 3401	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3402	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3403	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 3404	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 3411	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3412	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3416	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 3417	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 4001	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 4002	RES.HI-TENSION	VR25 5% 3M3	4822 053 20335
R 4003	RES.HI-TENSION	VR25 5% 3M3	4822 053 20335
R 4004	RES.HI-TENSION	VR25 5% 3M3	4822 053 20335
R 4006	RES.HI-TENSION	VR25 5% 6M8	4822 053 20685
R 4007	RES.HI-TENSION	VR25 5% 6M8	4822 053 20685
R 4008	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 4009	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 4031	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 4032	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 4033	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 4034	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 4036	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 4037	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 4038	RES.CHIP	RC-02H 1% 681E	4822 051 56811
R 4039	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 4040	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 4041	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 4042	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 4043	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 4044	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 4051	RES.HI-TENSION	VR25 5% 3M3	4822 053 20335

Item	Description		Ordering code
R 5001	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5002	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5003	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5004	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5007	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5008	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5101	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5106	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5111	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5116	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5121	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5126	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5131	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5132	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5133	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5134	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5136	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5137	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 5138	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 5139	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 5151	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 5201	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5206	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5211	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5216	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5221	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5226	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5251	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 5301	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5306	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5311	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5316	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5321	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5326	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5351	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 5411	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 5416	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014

SEMI CONDUCTORS

V 1009	DIODE,CHIP	BBY39 PEL	5322 130 82199
V 1011	DIODE,CHIP	BBY39 PEL	5322 130 82199
V 1014	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1016	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1018	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1019	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1021	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1022	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1023	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 1024	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136

Item	Description		Ordering code
V 1101	TRANSISTOR,CHIP	BFR53 PEL	5322 130 61244
V 1102	TRANSISTOR,CHIP	BFR53 PEL	5322 130 61244
V 1103	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 1104	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 1106	TRANSISTOR	BFG55 PEL	5322 130 62806
V 1107	TRANSISTOR	BFG55 PEL	5322 130 62806
V 1108	DIODE	BZX79-C12 PEL	4822 130 34197
V 1109	DIODE	BZX79-C12 PEL	4822 130 34197
V 1111	TRANSISTOR,CHIP	BFG35 PEL	5322 130 62805
V 1112	TRANSISTOR,CHIP	BFG35 PEL	5322 130 62805
V 1113	DIODE	BBY62 PEL	5322 130 82685
V 1121	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1122	TRANSISTOR,CHIP	BCP53 PEL	5322 130 62804
V 1123	TRANSISTOR,CHIP	BCP56 PEL	5322 130 63033
V 1126	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 1127	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1128	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 1201	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1202	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1203	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1204	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1301	DIODE,CHIP	BZX84-C8V2 PEL	5322 130 80255
V 2061	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 2062	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 2101	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 2102	DIODE,CHIP	BZX84-C18 PEL	5322 130 80212
V 2103	DIODE,CHIP	BZX84-C18 PEL	5322 130 80212
V 2104	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 2111	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V 2113	TRANSISTOR	BFQ232 PEL	4822 130 62437
V 2131	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 2132	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 2133	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V 2134	TRANSISTOR	BFQ252 PEL	4822 130 62708
V 2201	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 2202	DIODE,CHIP	BZX84-C18 PEL	5322 130 80212
V 2203	DIODE,CHIP	BZX84-C18 PEL	5322 130 80212
V 2204	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 2211	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V 2213	TRANSISTOR	BFQ232 PEL	4822 130 62437
V 2231	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 2232	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 2233	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V 2234	TRANSISTOR	BFQ252 PEL	4822 130 62708
V 2301	DIODE,CHIP	BZX84-C8V2 PEL	5322 130 80255
V 2403	DIODE,CHIP	BZX84-C18 PEL	5322 130 80212
V 2418	DIODE,CHIP	BZX84-C8V2 PEL	5322 130 80255
V 3001	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 3002	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 3061	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383

Item	Description		Ordering code
V 3062	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 3101	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 3102	DIODE,CHIP	BZX84-C18 PEL	5322 130 80212
V 3103	DIODE,CHIP	BZX84-C18 PEL	5322 130 80212
V 3104	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 3111	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V 3113	TRANSISTOR	BFQ232 PEL	4822 130 62437
V 3131	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 3132	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 3133	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V 3134	TRANSISTOR	BFQ252 PEL	4822 130 62708
V 3136	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 3137	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 3201	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 3202	DIODE,CHIP	BZX84-C18 PEL	5322 130 80212
V 3203	DIODE,CHIP	BZX84-C18 PEL	5322 130 80212
V 3204	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 3211	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V 3212	TRANSISTOR,CHIP	BF820 PEL	5322 130 62802
V 3213	TRANSISTOR	BFQ232 PEL	4822 130 62437
V 3231	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 3232	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 3233	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V 3234	TRANSISTOR	BFQ252 PEL	4822 130 62708
V 3236	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 3237	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 3281	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 3282	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V 3301	TRANSISTOR,CHIP	BF820 PEL	5322 130 62802
V 3311	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 3312	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 3418	DIODE,CHIP	BZX84-C8V2 PEL	5322 130 80255
V 4001	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 4002	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V 4003	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V 4004	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V 4031	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V 4032	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V 4033	TRANSISTOR,CHIP	BF820 PEL	5322 130 62802
V 4034	TRANSISTOR,CHIP	BF820 PEL	5322 130 62802
V 4036	DIODE,CHIP	BZX84-B24 PEL	4822 130 82709
V 4037	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 4038	TRANSISTOR,CHIP	BF820 PEL	5322 130 62802
V 4039	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V 4040	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 4041	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 4042	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 4043	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 4044	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 5001	DIODE,CHIP	BAS21 PEL	4822 130 33702

Item	Description		Ordering code
V 5002	DIODE,CHIP	BAS21 PEL	4822 130 33702

CONNECTORS AND SOCKETS

X 2101	CONNECTOR	4-P HAAKS OMSL	5322 265 30907
X 2301	CONNECTOR	P 1.25MM STR	4822 267 50668
X 2401	CONNECTOR	P 1.25MM STR	4822 267 50668
X 2402	CONNECTOR	3-P SNG RT.ANG	5322 265 30433
X 2403	SOCKET	55595 PEL	5322 255 40502
X 2501	CONNECTOR	50-P DBL STRGHT	5322 265 61242

5.2.7 Description of A2-100 MHz version.

5.2.7.1 Final Y amplifier.

Diagram 1.

The output signal from the delay line is applied to the input pins 6 and 9 of amplifier IC D1001. This IC and surrounding components comprise the MF and HF square wave compensations. Also the vertical CRT text signal is applied to D1001 (pin 15 and 16). The switching between text/cursors and signal is done via control signals that are applied to pin 17 and 18 of D1001. Text is written if the voltage at pin 18 is higher than at pin 17. This switching signal is derived from the collector of the transistors V1201 and V1202. The control signals XYSW1 and XYSW0 come from the text/cursor generator IC on microprocessor unit A3. Via the transistors V1203 and V1204 similar switching signals XSW1 and XSW0 are routed to the X-deflection section for switching between text and signal.

The output signals from pin 21 and 22 of D1001 are routed via the common base circuits V1026 / V1027 to the final Y-amplifier. The final amplifier is located on the small printed circuit board at the CRT socket. It drives the vertical deflection plates of the CRT. This final stage is indicated on diagram 2.

The delay line leads are terminated into 75Ω. The impedance is composed by 300Ω inside D1001 parallelled by external impedances of 60Ω formed by the external resistors R1024/R1026 and R1027/R1028. All termination resistors are applied to a voltage controlled by D1001/pin 13. Pin 13 determines the common mode voltage level of the D1001 inputs. The HF square wave compensation is achieved by the two dual varicap diodes V1009 and V1011 together with associated resistors.
Varicap V1009 is controlled by the output signal at pin 20 of octal DAC N1001. This output voltage can be in the range 0 to 10 V and controls varicap V1009 via operational amplifier N1002/1,2,3. This operational amplifier converts the N1001 output voltage (that is related to 0 V) into a voltage related to the voltage at D1001/pin 13.
Varicap V1011 is controlled by the output signal at pin 18 of octal DAC N1001. This output voltage can be in the range 0 to 10 V and controls varicap V1011 via operational amplifier N1002/5,6,7. This operational amplifier converts the N1001 output voltage (that is related to 0 V) into a voltage related to the voltage at D1001/pin 13.

LF square wave compensation is also done inside D1001. This is controlled via currents applied to pin 27 and 28. These currents are derived from the N1001 DAC voltage outputs 13 and 11 via the transistors V1014 and V1016. The actual compensating components are situated outside D1001 and are R1037/C1011/R1038 and R1029/C1009/R1031. V1023 and V1024 form a 20 mA current source to supply the bias current for the final stage inside D1001. V1024 is switched as a diode and gives temperature compensation.

Offset is adjusted via the currents from the collectors of V1021 and V1022. These currents are controlled by the DAC output pins 17 (coarse) and 16 (fine). Two parallel DAC outputs are used to obtain sufficient resolution. V1018 is a current source and V1019 is for temperature compensation. Gain control occurs via an adjustable current applied to D1001/pin 26. This is done via N1001/pin 14 and R1051

DAC output N1001/15 applies via operational amplifier N1003/1,2,3 the signal YFSHF to the final stage on diagram 2. YFSHF is an adjustable dc voltage that is applied to varicap diodes V4113 that control the HF square wave response of the output stage.

The circuit with operational amplifier N1004/2,3,6 is used for automatic calibration of the vertical deflection. It measures the voltage at the vertical deflection plates of the CRT. This value is applied as signal YCAL to the microprocessor on unit A3.

Diagram 2.

This diagram shows the Y-output amplifier. The amplifier is located at the small printed circuit board at the CRT socket. The input signal is a current and is applied to V4101 and V4102. The output signal is voltage and is applied to the vertical deflection plates of the CRT. Total sensitivity at the plates is 4V/div. One plate is driven by output stage V4111/V4108. V4111 and V4114 form a current source. The current source is an amplifier for higher frequencies because of coupling capacitor C4118. The driver transistors are V4103 and V4106. The input signal is YPREOUT1.

The other plate is driven by output stage V4109/V4112. V4112 is a current source. The current source is an amplifier for higher frequencies because of coupling capacitor C4119. The driver transistors are V4104 and V4107. The input signal is YPREOUT0.

The output signals ACALFB0 and ACALFB1 are routed to a circuit for automatic calibration of the vertical amplifiers. This circuit is present on the larger part of unit A2 and indicated on diagram 1

5.2.7.2 Final X and Z amplifiers.

Diagram 3.

This diagram shows the final X amplifier. It drives the horizontal plates of the CRT. Total plate sensitivity equals 8.5 V/div. The input circuit is formed by IC D2001. The octal DAC N2002 supplies the analog control signals that are used throughout the circuit.

Input pin 5 and 6 of D2001 receive the time base sawtooth or the X- deflection signal signal. Input pin 9 and 10 receive the horizontal text/cursor signal. The selection between text/cursors and sawtooth/X- deflection signal is done via the signals XSW0 and XSW1 that are applied to pin 7 and 8 of D2001. These signals are derived from XYSW0 and XYSW1 that come from the text generator IC on microprocessor unit A3. Text is displayed with XSW0 at 0 mA and XSW1 at 1 mA. Trace is displayed with XSW0 at 1 mA and XSW1 at 0 mA.

Gain control is possible via pin 1 of D2001. This is used for trace gain control via signal XTRAGC. Gain control to compensate for CRT tolerances is achieved via pin 14 of D2001. This is controlled via the DAC output signals XCRTGCL (fine) and XCRTGCH (coarse). Offset control to compensate for CRT tolerances is achieved via pin 15 of D2001. This is controlled via the DAC output signals XCRTOFH (coarse) and XCRTOFL (fine). Adjustment of the HF response (and linearity) is achieved via signal XHFADJ via pin 17 and 26 of D2001.

The final X-amplifier consists of two identical halves that receive input signals that are in opposite phase. These signals originate from the D2001 outputs pin 24/25 (XDRIL0/XDRIL1) and pin 18/19 (XDRIR0/XDRIR1). The two X-amplifier sections drive respectively the left and right deflection plate of the CRT.

The final X amplifier half that drives the left deflection plate is explained now. Its function is identical to that of the other amplifier half. The balanced input signals XDRIL1 and XDRIL0 are applied to input stage V2101. V2134 is a current source. XDRIL0 is not used and connected to +6.8 V. In the collector circuit of V2101 are the zener diodes V2102/V2103 that function as level shifters. The emitter followers V2132 and V2111 supply the output stage V2134/V2113 with signal. V2113 functions as an amplifier stage and V2134 mainly as a current source. V2134 receives signal via C2131 and C2134 and functions as amplifier stage in the fastest sweep speeds. Via R2133/R2134 however some dc drive is also applied to V2134.

The circuit with operational amplifier N2003 is used to measure the output voltage that is applied to the X-deflection plates of the CRT. This measurement is done via high-ohmic resistors R2301 and R2302. The analog output voltage XCAL of N2003 is applied to an ADC incorporated in the microprocessor on unit A3. This enables the microprocessor to exactly measure the horizontal output voltage. This is used for automatic calibration of the horizontal deflection.

Diagram 4.

This diagram shows the final intensity (Z) and focusing amplifiers. These amplifiers drive the intensity electrode G1 and the focusing electrode G3 of the CRT. The input circuit is formed by IC D3001.

Input pin 5 and 6 of D3001 receive the Z-pulses ZLTRA0 and ZLTRA1 that determine the intensity during signal display. Input pin 9 and 10 receive the Z-pulse ZTXT0 and ZTXT1 that determine the intensity during text/cursor display. The selection between signal intensity and text intensity is done via the signals ZSW0 and ZSW1 that are applied to pin 7 and 8 of D3001. These signals originate from the text generator IC on microprocessor unit A3. Text is displayed with ZSW0 at 0 mA and ZSW1 at 1 mA. Trace is displayed with ZSW0 at 1 mA and ZSW1 at 0 mA.

The final Z-amplifier and the focusing amplifier are identical halves that receive input signals that are in opposite phase. These signals originate from the D3001 outputs pin 24/25 (ZDRIF1/ZDRIF0) and pin 18/19 (ZDRII0/ZDRII1).

Via V3002 part of the ripple on the negative CRT cathode voltage (ZRIPPLE) is applied to pin 15 of D3001. This compensates for unwanted intensity modulation due to this ripple.
The diodes V3236, V3136, V3237 and V3137 protect D3001 against possible high voltage surges.

V3301 supplies the intensity determining signal INTEN-DA. This signal adjusts the "dark level" of the CRT. V3301 is controlled by DAC N2002 output signal DARK. V3311 supplies signal ASTIG that determines the astigmatism of the CRT. V3311 is controlled by DAC N2002 output signal ASTDR.

The upper amplifier half that is used for the dynamic focus control is explained now. Its function is identical to that of the lower amplifier half that is used for intensity (Z) control. The balanced input signals ZDRIF1 and ZDRIF0 are applied to input stage V3101. ZDRIF0 is not used and connected to +6.8 V. In the collector circuit of V3101 are the zener diodes V3102/V3103 that function as level shifters. The emitter followers V3132 and V3111 supply the output stage V3134/V3113 with signal. V3113 functions as an amplifier stage and V3134 mainly as a current source. V3134 receives signal via C3131 and C3134. It mainly functions as amplifier stage for fast input signals. Via R3133/R3134 however some dc drive is also applied to V3134.

Diagram 5.

In this diagram the circuit is shown that forms an interface between the signals that determine the intensity/focusing and the CRT electrodes G1/G3 that control intensity/focusing. These electrodes, the cathode and filament (heater) of the CRT are at a high negative voltage. This voltage is separated from the other oscilloscope circuits via the 3kV capacitors C4004, C4061, C4036 and C4037.

The intensity is influenced by the output signal INTEN-AA of the Z- amplifier and the signal INTEN-DA. INTEN-AA is determined via the front-panel INTENS TRACE, INTENS TEXT, MTB on, DTB on and chopper blanking control signals. The HF component in the INTEN-AA signal is applied to G1 of the CRT via C4037. The DC and LF components are applied to the base of V4034. The INTEN-DA signal is applied to the base of V4032 and forms the clamplevel (dark level) of the DC and LF part of INTEN-AA derived from V4034. These two transistors form the inputs of a 150kHz modulator that basically consists of V4031 and V4033. The LF and DC components that are modulated on the 150 kHz carrier signal can pass via buffer stage V4038/V4039 and then via high voltage blocking capacitor C4036.
Behind capacitor C4036 demodulation takes place via the diodes V4043 and V4044. This results in the original INTEN-AA signal that is superpositioned on the INTEN-DA voltage that corrects the cut-off voltage of the CRT applied to G1 and via R4051 also to G3. Across R4044 a small negative voltage (compared with the cathode) is developed for G1. This voltage is not big enough to make the CRT screen dark. This means that the signals to darken the screen and to control intensity are applied via C4036 and C4037.

The HF component from the focusing amplifier output signal FOCUS-AA is applied to G3 via C4004 and voltage divider R4008/R4009/C4002/C4003. This assures optimal tracking between focus and intensity. The signal FOCUS-DA is determined via the FOCUS control at the instruments front panel. The signal FOCUS-DA is then mixed with the LF component of FOCUS-AA before its level is adapted to the nominal G3 voltage via transistors V4002/V4003/V4004.

Diagram 6.

This diagram shows the RC-branches and regulators N5131 that give the supply voltages for the various circuits. Also the connectors X2501 and X2301 are indicated here. X2301 is the connector where the flat cable leaves for the small unit that incorporates the CRT-socket X2403. The flat cable arrives at the small CRT-socket unit at X2411.

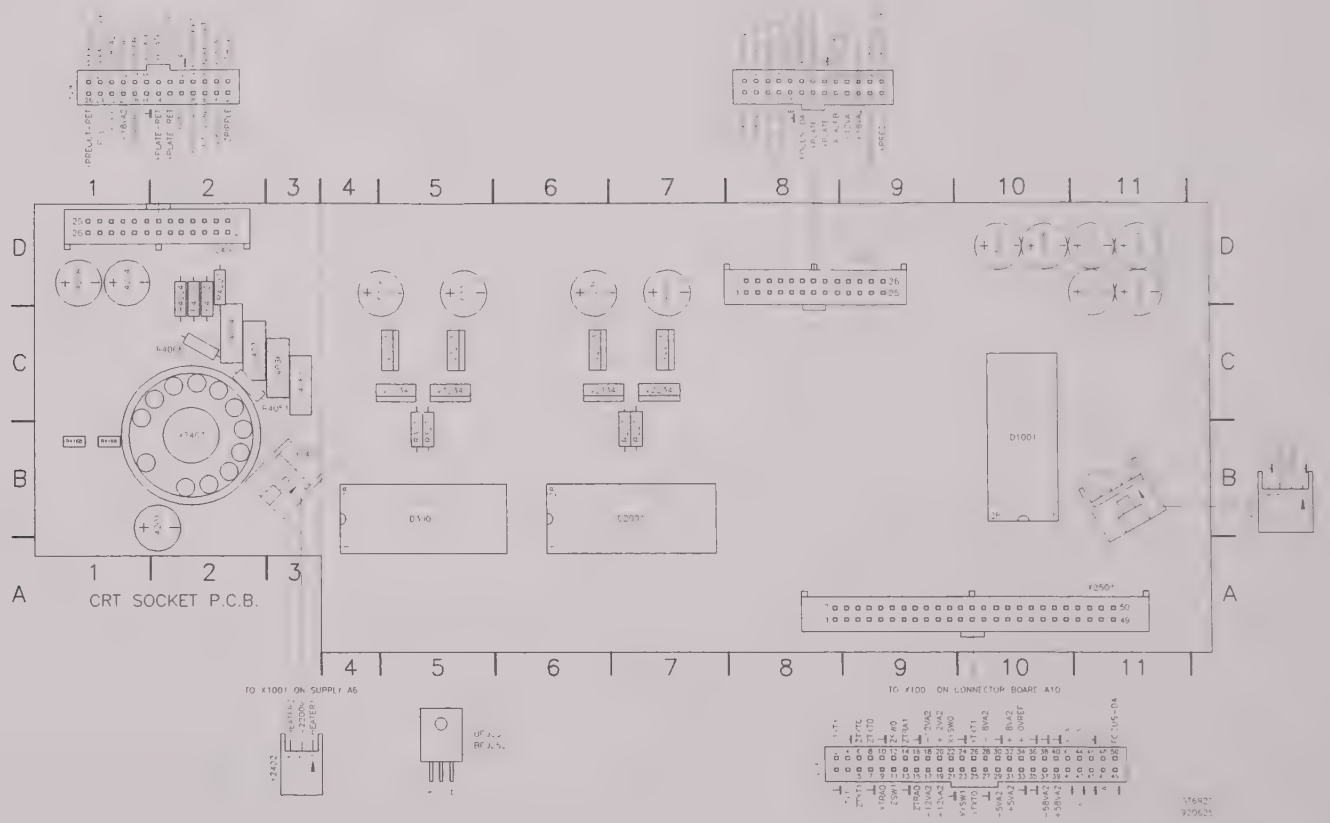
5.2.8 Signal name list A2-100 MHz version

Note: In the signal name list you find the itemnumber of the component that is source or destination. Behind this itemnumber (separated by ":") you find the number of the diagram where the source/destination can be found

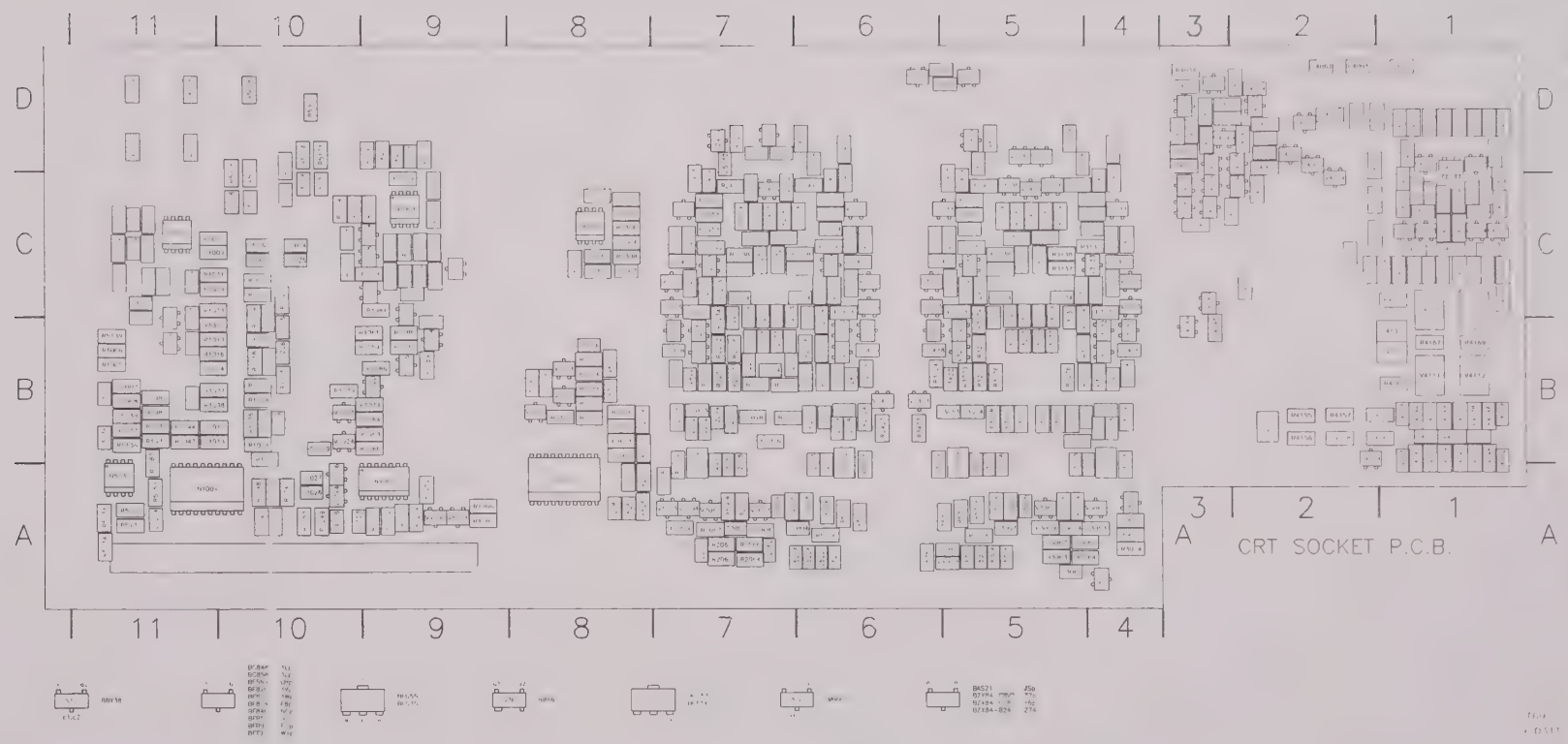
NAME	MEANING	SOURCE	DESTINATION
ACALF B0	AUTOCALL FUNCTION SIGNAL	R4164:02	X2411:02
		X2301:01	R1307:01
ACALF B1	AUTOCALL FUNCTION SIGNAL	R4163:02	X2411:02
		X2301:01	R1306:01
ASTDR	DRIVER SIGNAL FOR ASTIGMATISM	N2002:03	R3313:04
ASTIG	ASTIGMATISM CONTROL	V3311:04	X2301:06
		X2411:06	X2403:05
DARK	DRIVER SIGNAL FOR DC PART INTENS	N2002:03	V3301:04
FOCUS-AA	AC PART FOCUSING SIGNAL	R3161:04	X2301:06
		X2411:05	R4008:05
FOCUS-DA	DC PSRT FOCUSING SIGNAL	X2501:06	X2301:06
		X2411:05	R4001:05
G1	INTENSITY GRID 1 OF CRT	C4037:05	X2403:05
			R4044:05
G3	FOCUSING GRID 3 OF CRT	C4004:05	X2403:05
			R4051:05
HEATER1	FILAMENT SUPPLY F1 OF CRT	X2402:05	X2403:05
HEATER2	FILAMENT SUPPLY F2 OF CRT	X2402:05	X2403:05
INTEN-AA	AC PART OF INTENSITY SIGNAL	R3261:04	X2301:06
		X2411:05	C4037:05
INTEN-DA	DC PART OF INTENSITY SIGNAL	V3301:04	X2301:06
		X2411:05	V4032:05
SCL	SERIAL CLOCK	X2501:06	J1002:06
			J2002:06
SDA	SERIAL DATA	X2501:06	J1002:06
			J2001:06
XCAL	AUTOCAL SIGNAL X DEFLECTION	R2313:03	X2501:06
XCRTGCH	CRT X-GAIN CONTROL HIGH	N2002:03	R2011:03
XCRTGCL	CRT X-GAIN CONTROL LOW	N2002:03	R2012:03
XCRTOFH	CRT OFFSET CONTROL HIGH	N2002:03	R2016:03
XCRTOFL	CRT OFFSET CONTROL LOW	N2002:03	R2017:03
XDRIL0	DRIVE SIGNAL 0 LEFT X AMPLIFIER	D2001:03	R2101:03
XDRIL1	DRIVE SIGNAL 1 LEFT X AMPLIFIER	D2001:03	R2103:03
XDRIR0	DRIVE SIGNAL 0 RIGHT X AMPLIFIER	D2001:03	R2203:03
XDRIR1	DRIVE SIGNAL 1 RIGHT X AMPLIFIER	D2001:03	R2201:03
XHFADJ	HF ADJUSTMENT X AMPLIFIER	N2002:03	R2021:03
XLTXT0	X SHIFT TEXT 0	V2062:03	R2007:03
XLTXT1	X SHIFT TEST 1	V2062:03	R2008:03
XOUT0	X OUTPUT 0	V2134:03	R2171:03
		V2113:03	R2302:03

NAME	MEANING	SOURCE	DESTINATION
XOUT1	X OUTPUT 1	V2234:03	R2271:03
		V2213:03	R2301:03
XPLATE0	X OUTPUT 0 TO CRT LEFT PLATE	R2161:03	X2411:02
XPLATE1	X OUTPUT 1 TO CRT RIGHT PLATE	R2261:03	X2411:02
XPLATEC0	X OUTPUT 0 TO CRT LEFT PLATE	R4261:02	X2403:02
XPLATEC1	X OUTPUT 1 TO CRT RIGHT PLATE	R4262:02	X2403:02
XSCL	SERIAL CLOCK X SECTION	J2002:06	N2002:03
XSDA	SERIAL DATA X SECTION	J2001:06	N2002:03
XSWO	X SWITCH SIGNAL 0 TRACE/TEXT	V1204:01	D2001:03
XSW1	X SWITCH SIGNAL 1 TRACE/TEXT	V1203:01	D2001:03
XTRA0	X TRACE 0 SIGNAL	X2501:06	R2006:03
XTRA1	X TRACE 1 SIGNAL	X2501:06	R2006:03
XTRAGC	X TRACE SIGNAL GAIN CONTROL	N2002:03	R2002:03
XTXT0	X TEXT 0 SIGNAL	X2501:06	R2063:03
XTXT1	X TEXT 1 SIGNAL	X2501:06	R2064:03
XYSWO	X/Y SWITCH SIGNAL 0 TRACE/TEXT	X2501:06	R1204:01
XYSW1	X/Y SWITCH SIGNAL 1 TRACE/TEXT	X2501:06	R1201:01
YCAL	AUTOCAL SIGNAL Y DEFLECTION	R1309:01	X2501:06
YFSHF	HF SQ WAVE RESPONSE FINAL Y	R1091:01	X2301:06
		X2411:02	R4181:02
			R4182:02
YFSHF1	HF SQ WAVE RESPONSE FINAL Y 1	R4181:02	V4113:02
YFSHF2	HF SQ WAVE RESPONSE FINAL Y 2	R4182:02	V4114:02
YPREOUT0	Y PREAMPLIFIER OUT 0	V1027:01	X2301:06
		X2411:02	R4112:02
YPREOUT1	Y PREAMPLIFIER OUT 1	V1026:01	X2301:06
		X2411:02	R4111:02
YSCL	SERIAL CLOCK Y SECTION	J1002:06	N1001:01
YSDA	SERIAL DATA Y SECTION	J1001:06	N1001:01
YSW0	Y SWITCH SIGNAL 0 TRACE/TEXT	V1202:01	D1001:01
YSW1	Y SWITCH SIGNAL 1 TRACE/TEXT	V1201:01	D1001:01
YTRA0	Y TRACE 0 OUT FROM DELAY LINE	X2101:01	D1001:01
YTRA1	Y TRACE 1 OUT FROM DELAY LINE	X2101:01	D1001:01
YTXT0	Y TEXT 0 SIGNAL	X2501:06	D1001:01
YTXT1	Y TEXT 1 SIGNAL	X2501:06	D1001:01
ZDRIF0	DRIVER SIGNAL 0 FOCUS AMPLIFIER	D3001:04	R3101:04
ZDRIF1	DRIVER SIGNAL 1 FOCUS AMPLIFIER	D3001:04	R3103:04
ZDRII0	DRIVER SIGNAL 0 INTENS AMPLIFIER	D3001:04	R3203:04
ZDRII1	DRIVER SIGNAL 1 INTENS AMPLIFIER	D3001:04	R3201:04
ZLTRA0	Z LEVEL TRACE INTENSITY 0	V3062:04	R3004:04
ZLTRA1	Z LEVEL TRACE INTENSITY 1	V3061:04	R3006:04
ZOUTF	FEEDBACK SIGNAL FOCUS AMPLIFIER	V3113:04	R3171:04
ZOUTI	FEEDBACK SIGNAL INTENSITY AMPLIFIER	V3213:04	R3271:04
ZRIPPLE	RIPPLE ON NEGATIVE HIGH VOLTAGE	C4061:05	X2411:05
		X2301:06	R3014:04
ZRSUP	Z RIPPLE SUPPRESS	V3002:04	D3001:04
ZSW0	Z SWITCH SIGNAL O TEXT/TRACE	X2501:06	D3001:04
ZSW1	Z SWITCH SIGNAL 1 TEXT/TRACE	X2501:06	D3001:04
ZTRA0	Z TRACE INTENSITY 0	X2501:06	R3063:04
ZTRA1	Z TRACE INTENSITY 1	X2501:06	R3064:04
ZTXT0	Z TEXT 0 SIGNAL	X2501:06	R3007:04
ZTXT1	Z TEXT 1 SIGNAL	X2501:06	R3008:04

5.2.9 Unit lay-outs A2-100 MHz version



Lay-out 1 - Large component side of XYZ amplifier unit A2-100 MHz



Lay-out 2 - Small component side of XYZ amplifier unit A2-100 MHz

5.2.10 Location List A2-100 MHz version

'-L' means that the component is located on the side with the large components. Otherwise the component is located on the side with small components.

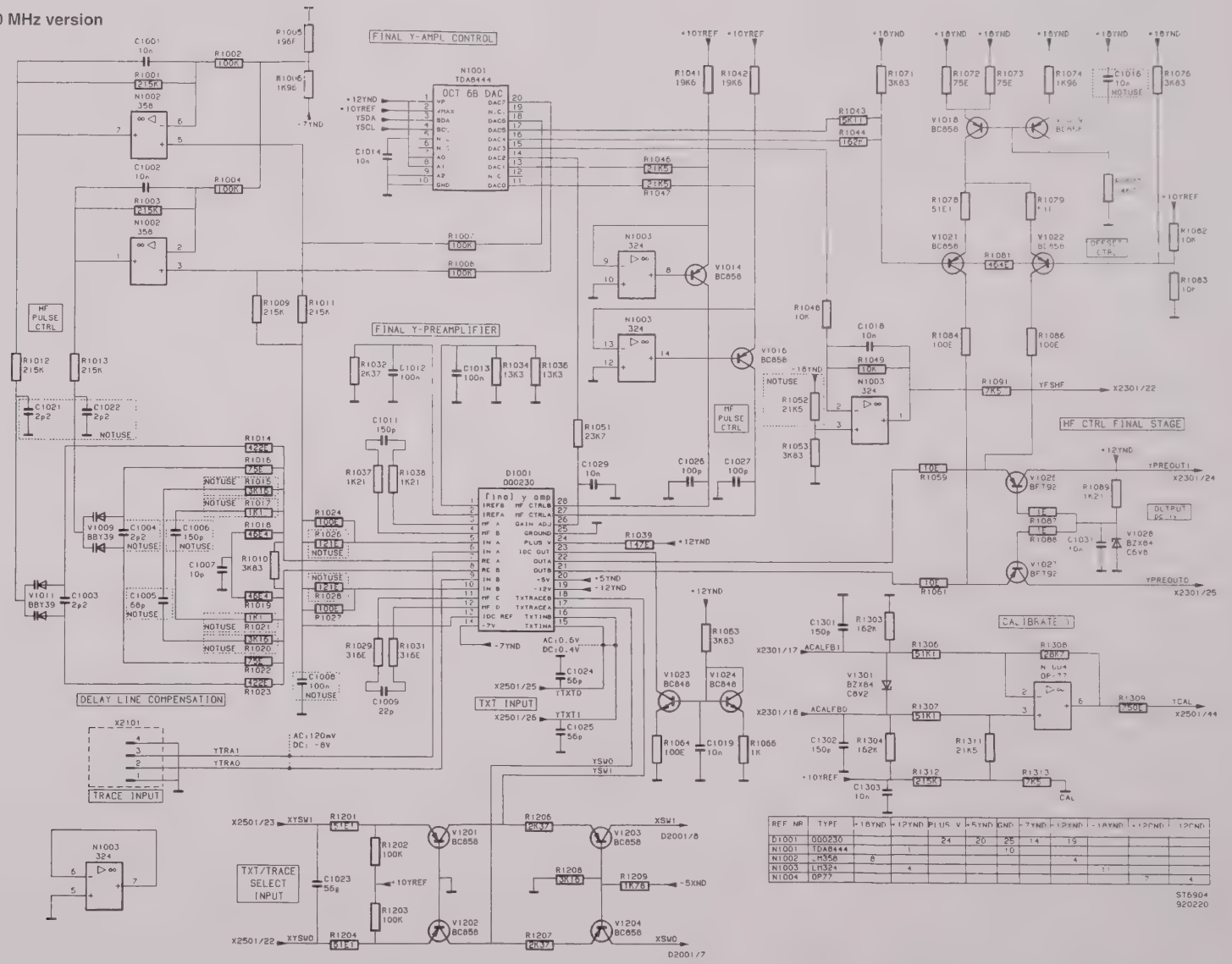
C1001 C11
C1002 C11
C1003 C11
C1004 B11
C1005 B10
C1006 B10
C1007 B10
C1008 C10
C1009 C11
C1011 B11
C1012 B11
C1013 B11
C1014 A11
C1016 C10
C1018 A10
C1019 B10
C1021 C11
C1022 C11
C1023 A10
C1024 C10
C1025 C10
C1026 A10
C1027 A10
C1029 B10
C1031 C9
C1301 C9
C1302 C9
C1303 C9
C2001 A6
C2002 A6
C2003 A6
C2004 A7
C2006 A7
C2007 A7
C2008 A7
C2009 A7
C2011 A7
C2012 B7
C2013 B7
C2014 B7
C2016 B6
C2017 B6
C2018 B6
C2019 B6
C2021 A7
C2022 B7
C2061 A7
C2062 A7
C2081 A8
C2103 C6
C2131 B6
C2132 C7
C2133 C7
C2134 C7
C2151 C6
C2171 C7
C2172 B7
C2173 B7
C2174 B7
C2176 C7
C2177 B7
C2203 C7
C2231 B7
C2232 C7
C2233 C7
C2234 C7
C2251 C7
C2271 C7
C2272 B7
C2273 B7
C2276 C7
C2277 B7
C2301 D7
C2302 D7
C2303 C8
C2413 C7
C2416 B6
C2417 C6
C2418 B7
C2419 C7
C2421 B6
C2422 B7
C3001 A5
C3002 A4
C3003 A5
C3004 A5
C3006 A5
C3007 A5
C3008 A5
C3009 A5
C3011 A5
C3013 B6
C3014 B5
C3016 B5
C3017 B4
C3018 B4
C3019 B4
C3021 A5
C3061 A5
C3103 C4
C3131 C5
C3132 C5
C3133 C5
C3134 C5
C3151 C5
C3171 C5
C3172 B5
C3173 B5
C3176 C5
C3203 C6
C3231 B5
C3232 C5
C3233 C5
C3234 C5
C3251 C5
C3271 C5
C3272 B5
C3273 B5
C3276 C5
C3412 C5
C3416 B4
C3417 C4
C3418 B6
C3419 C5
C3421 B4
C3422 B6
C4001 D2
C4002 D2
C4003 D2
C4004 C2-L
C4031 D3
C4032 C3
C4033 D3
C4034 D2
C4036 C3-L
C4037 C2-L
C4051 C2
C4061 C3-L
C4062 D2
C4111 C1
C4112 C1
C4113 C1
C4114 C1
C4116 C1
C4117 C1
C4118 B1
C4119 B1
C4121 C1
C4122 B1
C4123 B1
C4124 C1
C4163 D1
C4201 B1-L
C4202 B1
C4203 B1
C4204 D1-L
C4206 C1
C4207 C1
C4208 D1-L
C4209 C1
C5001 D11-L
C5002 D11-L
C5003 D11-L
C5004 D11-L
C5007 D10-L
C5008 D10-L
C5011 D6
C5012 D6
C5101 C10
C5111 C10
C5116 C10
C5121 C10
C5126 C10
C5136 B11
C5138 C10
C5151 B11
C5201 A6
C5206 A6
C5211 A6
C5216 A7
C5231 D7-L
C5232 D7
C5236 D6-L
C5238 D6
C5251 A8
C5301 A5
C5306 A5
C5311 A5
C5316 A5
C5321 B8
C5322 A6
C5326 B8
C5331 C5-L
C5332 D5
C5336 C5-L
C5338 D5
C5351 A6
C5411 D9
C5416 D9
D1001 B10-L

D2001 B7-L
D3001 B5-L
L4101 B2
L4102 B2
L4103 B2
N1001 A11
N1002 C11
N1003 A9
N1004 C9
N2002 A8
N2003 C8
N5131 A11
R1001 C11
R1002 C11
R1003 C11
R1004 C11
R1005 B11
R1006 B11
R1007 B11
R1008 B11
R1009 C11
R1010 B11
R1011 C11
R1012 C11
R1013 C11
R1014 B11
R1015 B10
R1016 B11
R1017 B10
R1018 B10
R1019 C10
R1020 C10
R1021 C10
R1022 C11
R1023 C11
R1024 B10
R1026 B10
R1027 C10
R1028 C10
R1029 C11
R1031 C11
R1032 B10
R1034 B10
R1036 B10
R1037 B11
R1038 B11
R1039 B10
R1041 A10
R1042 A10
R1043 B11
R1044 B11
R1046 A10
R1047 A10
R1048 A10
R1049 A10
R1051 B10
R1052 A9
R1053 A10
R1059 B10
R1061 B10
R1063 B10
R1064 B10
R1066 B10
R1071 B11
R1072 C10
R1073 C10
R1074 C10
R1076 B11
R1077 C10
R1078 C10
R1079 B10
R1081 B11
R1082 A11
R1083 B11
R1084 C10
R1086 B10
R1087 B9
R1088 B9
R1089 B9
R1091 D10
R1201 A10
R1202 A9
R1203 A9
R1204 A9
R1206 A9
R1207 A9
R1208 A7
R1209 A7
R1303 C9
R1304 C9
R1306 C9
R1307 C9
R1308 C9
R1309 D9
R1311 C9
R1312 C9
R1313 C9
R2001 A8
R2002 A8
R2003 A6
R2004 A6
R2006 A7
R2007 A7
R2008 A7
R2009 A7
R2011 B8
R2012 B8
R2013 B8
R2014 B8
R2015 B7
R2016 B8
R2017 B8
R2018 B7
R2020 B7
R2021 B7
R2023 B6
R2024 B6
R2026 B7
R2063 A7
R2064 A7
R2065 A7
R2066 A7
R2067 A7
R2068 A7
R2101 B6
R2102 B6
R2103 B6
R2104 B6
R2107 C6
R2111 C6
R2112 C6
R2114 C7
R2131 C6
R2132 C6
R2133 C6
R2134 B6
R2136 C6
R2137 C7
R2138 C7
R2151 C6
R2161 C7
R2171 B7-L
R2172 B7
R2176 B6
R2177 B6
R2201 B7
R2202 B7
R2203 B7
R2204 B7
R2207 C7
R2211 C7
R2212 C7
R2214 C7
R2231 C7
R2232 C7
R2233 C7
R2234 B7
R2236 C7
R2237 C7
R2238 C7
R2251 C7
R2261 C7
R2271 B7-L
R2272 B7
R2276 B7
R2277 B7
R2301 C7
R2302 C7
R2303 C8
R2304 C8
R2306 C8
R2307 C8
R2308 C8
R2309 C8
R2311 C8
R2312 C8
R2313 C8
R2411 C7
R2412 C7
R2416 C6
R2418 C7
R2419 D6
R2421 C6
R2422 C7
R2423 B6
R3001 B5
R3002 B5
R3003 A4
R3004 A5
R3006 A5
R3007 A5
R3008 A5
R3009 A6
R3011 B5
R3012 B5
R3013 A4
R3014 A4
R3015 A4
R3018 B5
R3021 B5
R3024 B4
R3026 B5
R3063 A5
R3064 A5
R3066 A5
R3067 A5
R3068 A5
R3069 A5
R3101 B5
R3102 B5
R3103 B4
R3104 B4
R3107 C4
R3111 C4
R3112 C5
R3114 C5
R3131 C4
R3132 C4
R3133 C5
R3134 B5
R3136 C5
R3137 C5
R3138 C5
R3151 C5

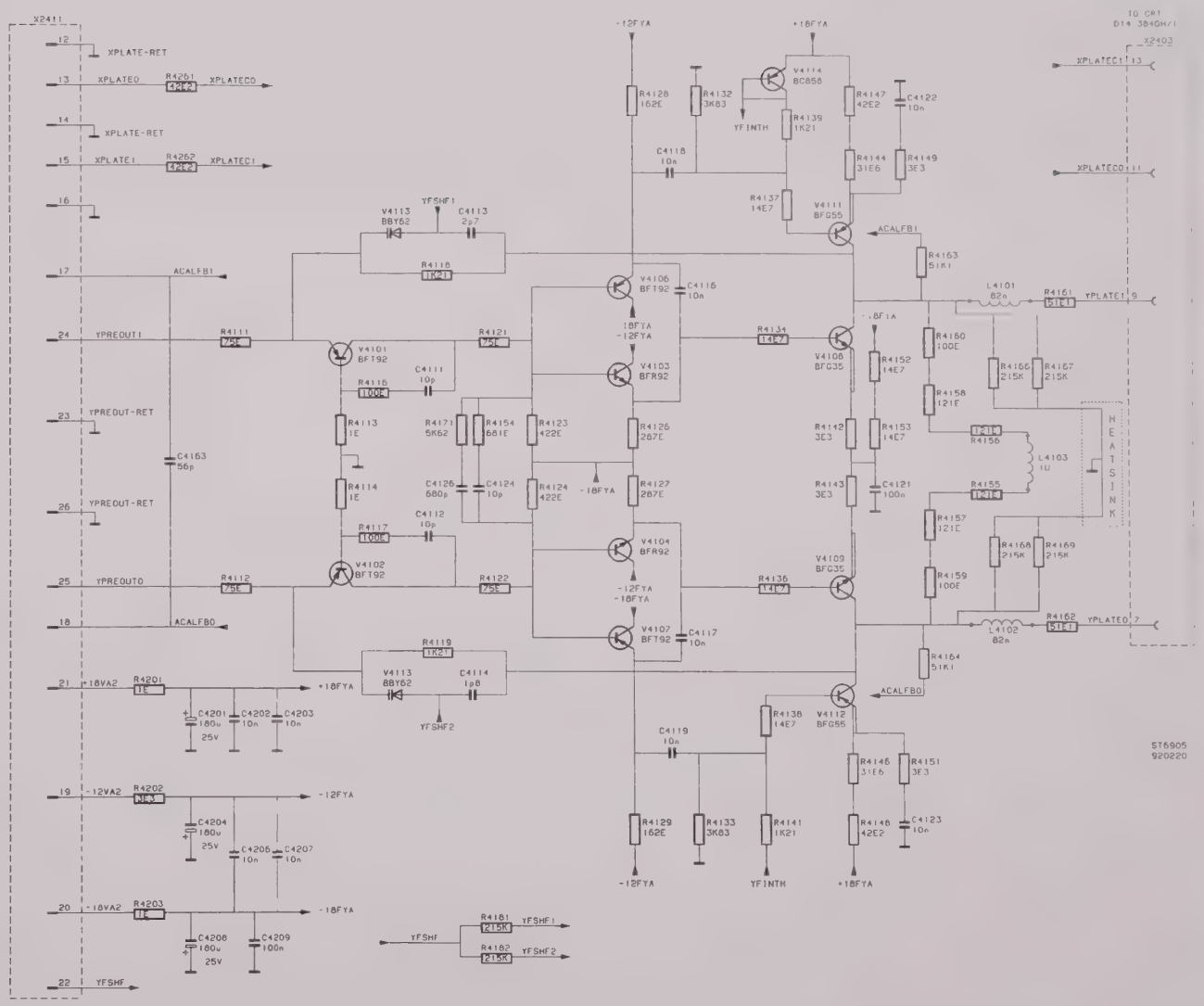
R3161 C5
R3171 B5-L
R3176 B5
R3201 B5
R3202 B5
R3203 B5
R3204 B6
R3207 C6
R3211 C6
R3212 C5
R3214 C5
R3231 C6
R3232 C5
R3233 C5
R3234 B5
R3236 C5
R3237 C5
R3238 C5
R3251 C5
R3261 C5
R3271 B5-L
R3276 B5
R3301 B8
R3302 B8
R3311 B8
R3312 B8
R3313 B8
R3314 B8
R3316 B8
R3411 C5
R3412 C5
R3416 C4
R3418 C6
R3419 D4
R3421 C4
R3422 C6
R3423 B6
R4001 D2
R4002 D2-L
R4003 D2-L
R4004 D2-L
R4006 C2-L
R4007 D2-L
R4008 D2
R4009 D2
R4031 D3
R4032 D3
R4033 D3
R4034 D3
R4036 D3
R4037 D3
R4038 D3
R4039 D3
R4040 D2
R4041 D3
R4042 C2
R4043 C3
R4044 C2
R4045 B3
R4051 C3-L
R4104 C2
R4111 D1
R4112 D1
R4113 D1
R4114 D1
R4116 D1
R4117 D1
R4118 C1
R4119 C1
R4121 C1
R4122 C1
R4123 C1
R4124 C1
R4126 C1
R4127 C1
R4128 C1
R4129 C1
R4131 B1
R4132 B1
R4133 B1
R4134 C1
R4136 C1
R4137 B1
R4138 B1
R4139 B1
R4141 B1
R4142 C1
R4143 C1
R4144 B1
R4146 B1
R4147 B1
R4148 B1
R4149 B1
R4151 B1
R4152 C2
R4153 C2
R4154 C1
R4155 B2
R4156 B2
R4157 B2
R4158 B2
R4159 B2
R4160 B2
R4161 B1
R4162 C1
R4163 C2
R4164 C2
R4166 B1-L
R4167 B1
R4168 B1-L
R4169 B1
R4181 D1
R4182 D1
R4201 D1
R4202 D2
R4203 D1
R4261 D2
R4262 D2
R5001 D11
R5002 D11
R5003 D11
R5004 D11
R5007 D10
R5008 D10
R5101 D10
R5111 D10
R5116 D10
R5121 D10
R5126 D10
R5131 A11
R5132 A11
R5133 A11
R5134 A11
R5136 B11
R5137 B11
R5138 B11
R5139 B11
R5151 A11
R5201 A6
R5202 A6
R5206 A6
R5211 A6
R5216 A6
R5231 D7
R5236 D7
R5251 A8
R5301 A5
R5306 A5
R5311 A6
R5316 A5
R5321 B8
R5326 B8
R5331 D5
R5336 D5
R5351 A6
R5411 D9
R5416 D9
R5501 C11
V1009 B11
V1011 C11
V1014 A10
V1016 A10
V1018 C10
V1019 C10
V1021 C10
V1022 B10
V1023 B10
V1024 B10
V1026 B9
V1027 C9
V1028 A9
V1201 B9
V1202 A9
V1203 A7
V1204 A7
V1301 C9
V2061 A7
V2062 A7
V2101 B6
V2102 C6
V2103 C6
V2111 C6
V2113 C7-L
V2131 B6
V2132 B6
V2133 C6
V2134 C7-L
V2201 B7
V2202 C7
V2203 C7
V2211 C7
V2213 C7-L
V2231 B7
V2232 B7
V2233 C7
V2234 C7-L
V2301 D7
V2413 C7
V2416 D7
V2421 B6
V3001 A4
V3002 A4
V3061 A5
V3062 A5
V3101 B4
V3102 C4
V3103 C4
V3111 C4
V3113 C5-L
V3131 C4
V3132 B4
V3133 C4
V3134 C5-L
V3136 C5
V3137 D5
V3201 B5
V3202 C6
V3203 C6
V3211 C6
V3213 C5-L
V3231 B6
V3232 B5
V3233 C5
V3234 C5-L

V3236 C5
V3237 D5
V3301 B8
V3311 B8
V3312 B8
V3413 C5
V3416 D5
V3421 B6
V4001 D2
V4002 D2
V4003 D2
V4004 D2
V4031 D3
V4032 D2
V4033 D3
V4034 C3
V4036 D3
V4037 D3
V4038 C3
V4039 C3
V4040 D3
V4041 C3
V4042 C3
V4043 C3
V4044 B3
V4084 C3
V4101 D1
V4102 D1
V4103 C1
V4104 C1
V4106 C1
V4107 C1
V4108 C1
V4109 C1
V4111 B1
V4112 B1
V4113 D1
V4114 B2
V5001 D6
V5002 D5
X2101 B11-L
X2301 D9-L
X2401 D2-L
X2402 B3-L
X2403 B2-L
X2501 A8-L

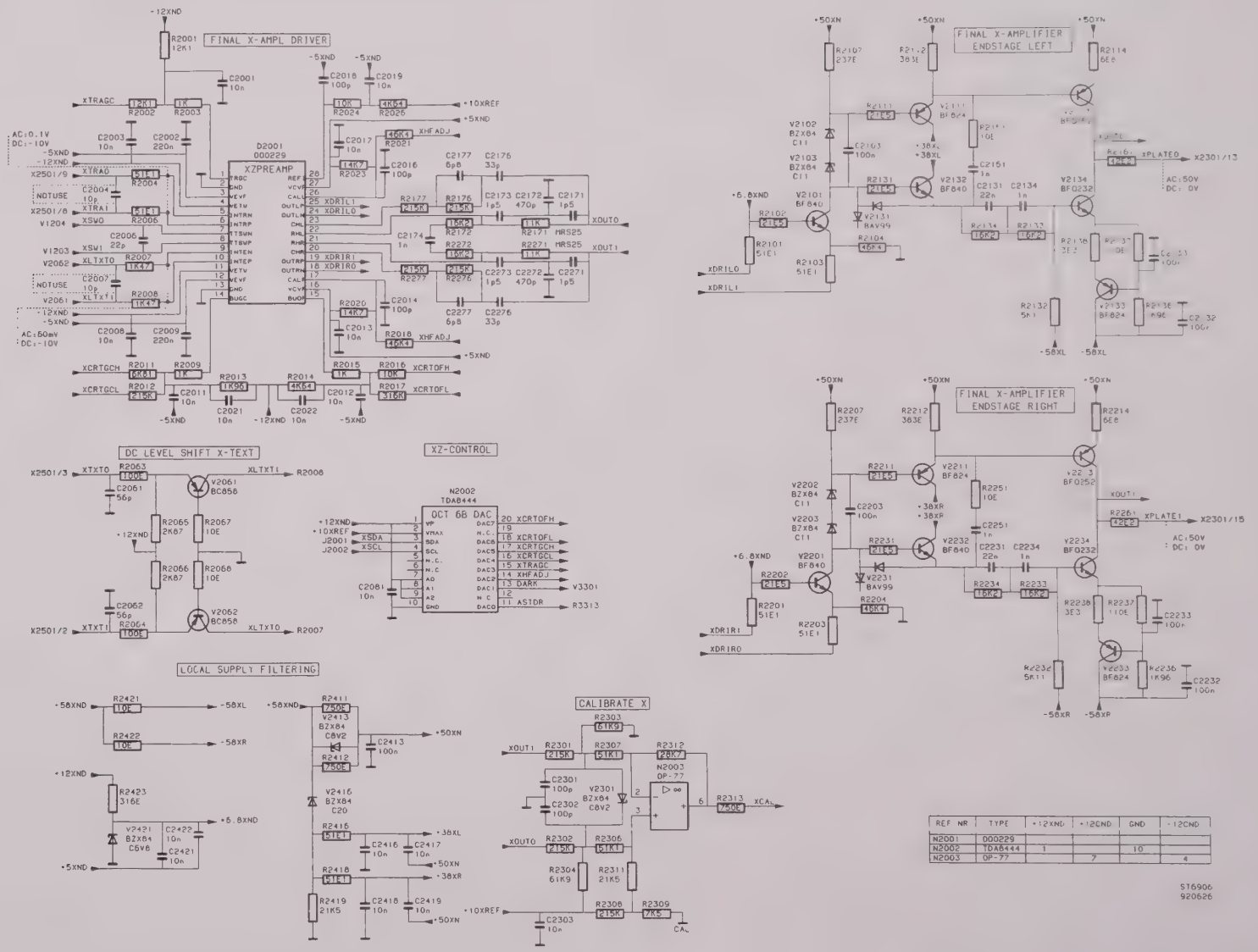
5.2.11 Circuit diagrams A2-100 MHz version



A2 (100 MHz) - Diagram 1a ; Final Y preamplifier and control



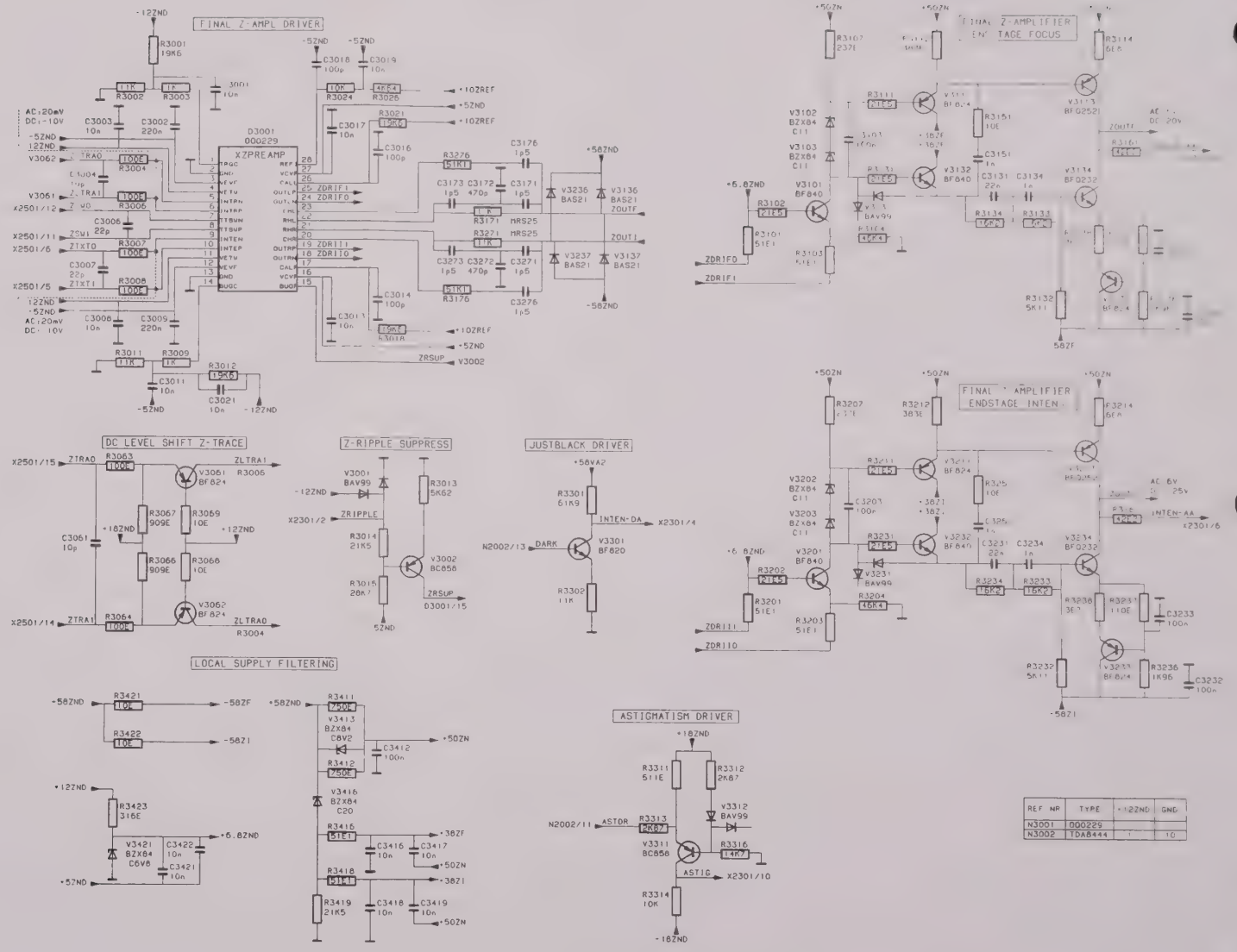
A2 (100 MHz) - Diagram 2a ; Final Y output stage



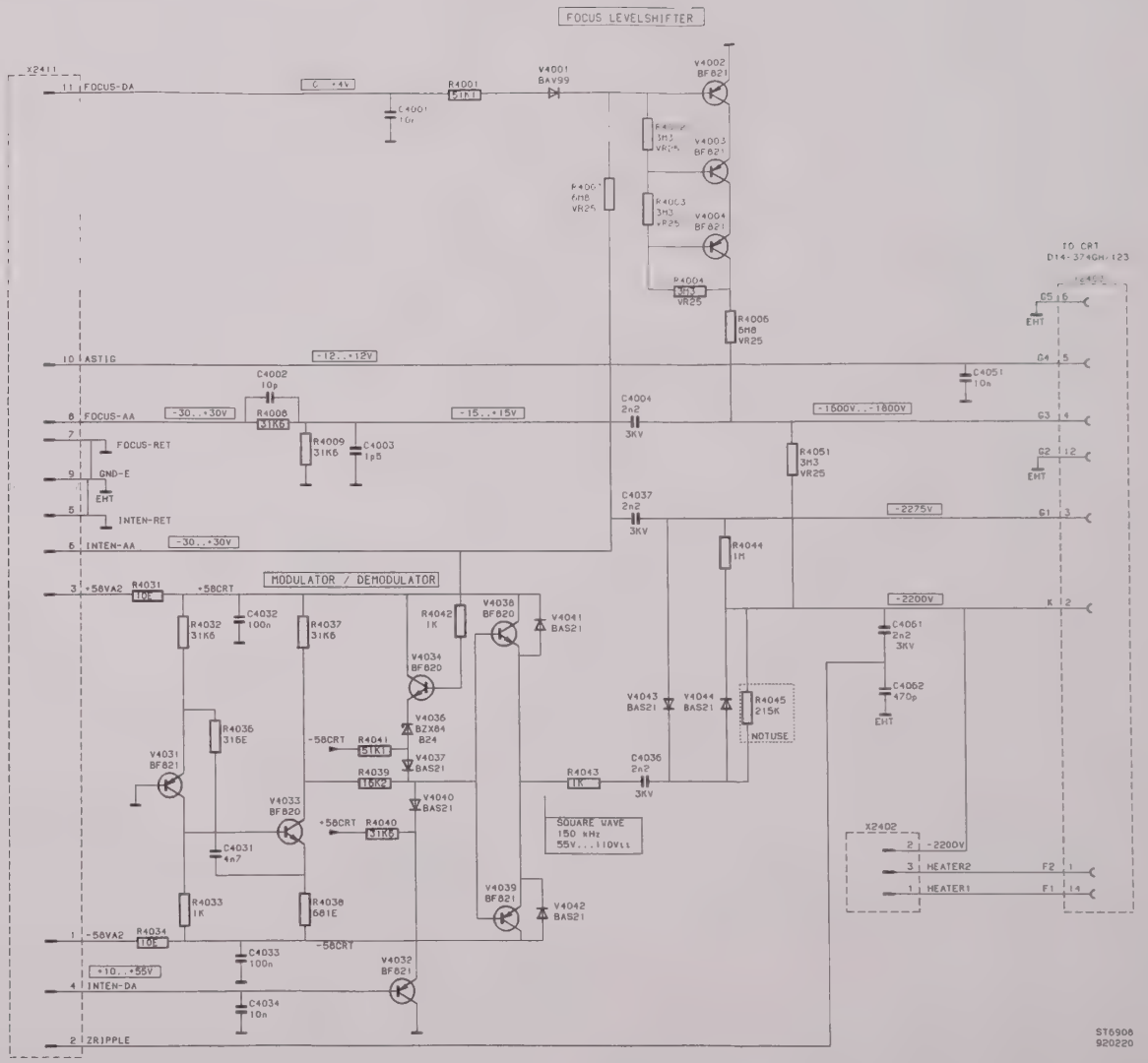
REF NR	TYPE	+12XND	+12CND	GND	-12CND
N2001	000229				
N2002	TDA8444	1		10	
N2003	OP-77		7		4

S16906
920626

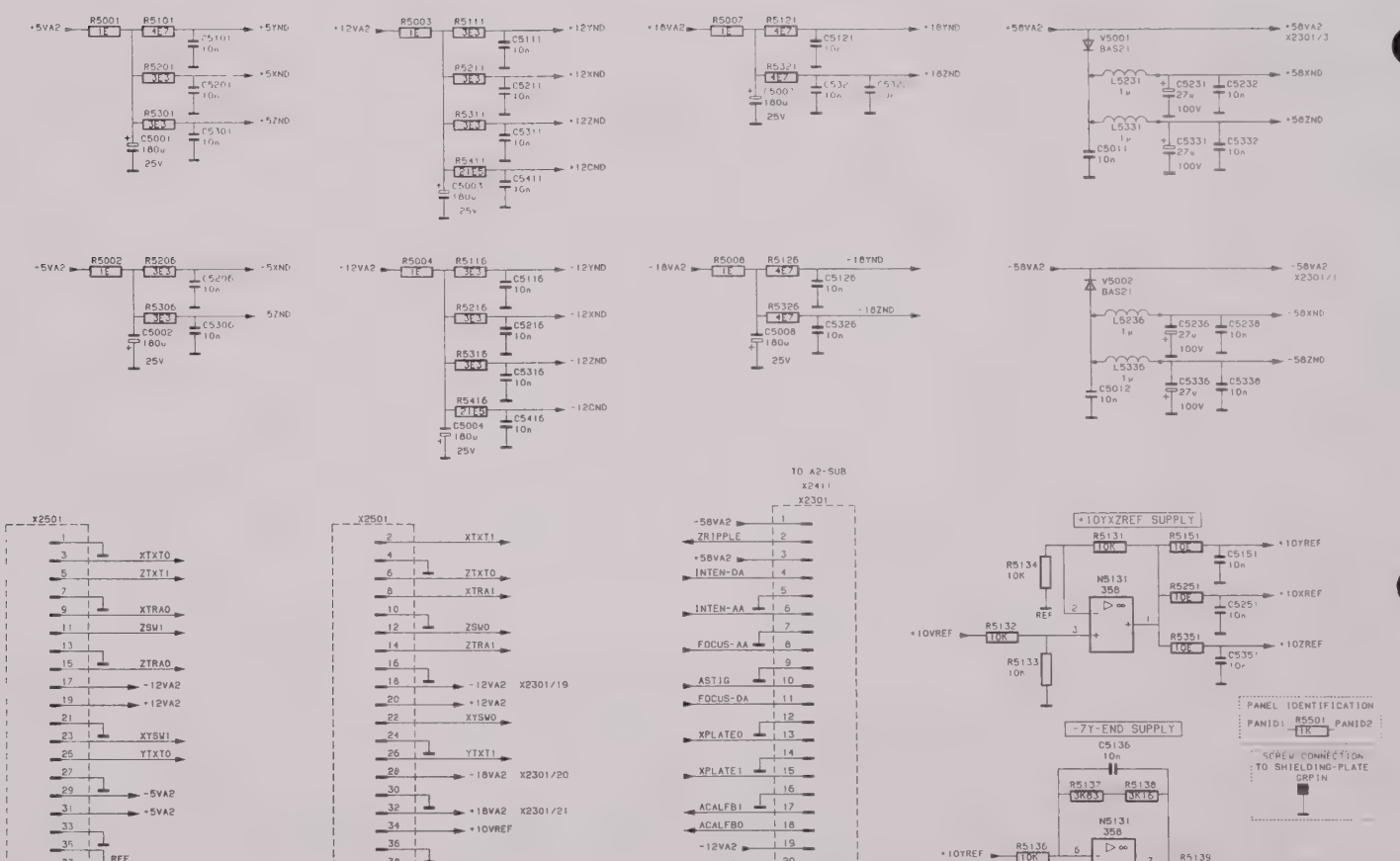
A2 (100 MHz) - Diagram 3a ; Final X amplifier and control



A2 (100 MHz) - Diagram 4a ; Final Z amplifier



A2 (100 MHz) - Diagram 5a ; Modulator/demodulator and focus control



A2 (100 MHZ) - Diagram 6a ; Supply circuits

5.2.12 Parts list A2-100 MHz version

CAPACITORS

Item	Description		Ordering code
C 1001	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1002	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1003	CAP.CHIP	63V 0.25pF 2.2pF	5322 122 33063
C 1007	CAP.CERAMIC	63V 5% 10pF	5322 122 32448
C 1009	CAP.CERAMIC	63V 5% 22pF	5322 122 32658
C 1011	CAP.CHIP	63V 5% 150pF	5322 122 33538
C 1012	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1013	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1014	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1018	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1019	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1023	CAP.CHIP	63V 5% 56pF	5322 122 32661
C 1024	CAP.CHIP	63V 5% 56pF	5322 122 32661
C 1025	CAP.CHIP	63V 5% 56pF	5322 122 32661
C 1026	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 1027	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 1029	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1031	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1301	CAP.CHIP	63V 5% 150pF	5322 122 33538
C 1302	CAP.CHIP	63V 5% 150pF	5322 122 33538
C 1303	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2001	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2002	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 2003	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2006	CAP.CHIP	63V 5% 22pF	5322 122 32658
C 2008	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2009	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 2011	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2012	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2013	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2014	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 2016	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 2017	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2018	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 2019	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2021	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2022	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2061	CAP.CHIP	63V 5% 56pF	5322 122 32661
C 2062	CAP.CHIP	63V 5% 56pF	5322 122 32661
C 2081	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2103	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 2131	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 2132	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 2133	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 2134	CAP.CHIP	63V 5% 1nF	5322 126 10511

Item	Description		Ordering code
C 2151	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 2171	CAP.CHIP	63V 0.25pF 1.5pF	5322 126 10225
C 2172	CAP.CHIP	63V 5% 470pF	5322 122 32268
C 2173	CAP.CHIP	63V 0.25pF 1.5pF	5322 126 10225
C 2174	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 2176	CAP.CHIP	63V 5% 33pF	5322 122 32659
C 2177	CAP.CHIP	63V 0.5pF 6.8pF	5322 122 32269
C 2203	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 2231	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 2232	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 2233	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 2234	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 2251	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 2271	CAP.CHIP	63V 0.25pF 1.5pF	5322 126 10225
C 2272	CAP.CHIP	63V 5% 470pF	5322 122 32268
C 2273	CAP.CHIP	63V 0.25pF 1.5pF	5322 126 10225
C 2276	CAP.CHIP	63V 5% 33pF	5322 122 32659
C 2277	CAP.CHIP	63V 0.5pF 6.8pF	5322 122 32269
C 2301	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 2302	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 2303	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2413	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 2416	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2417	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2418	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2419	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2421	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 2422	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3001	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3002	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 3003	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3004	CAP.CHIP	63V 5% 10pF	5322 122 32448
C 3006	CAP.CHIP	63V 5% 22pF	5322 122 32658
C 3007	CAP.CHIP	63V 5% 22pF	5322 122 32658
C 3008	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3009	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 3011	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3013	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3014	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 3016	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 3017	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3018	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 3019	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3021	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3061	CAP.CHIP	63V 5% 10pF	5322 122 32448
C 3103	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3131	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 3132	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3133	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3134	CAP.CHIP	63V 5% 1nF	5322 126 10511

Item	Description		Ordering code
C 3151	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 3171	CAP.CHIP	63V 0.25pF 1.5pF	5322 126 10225
C 3172	CAP.CHIP	63V 5% 470pF	5322 122 32268
C 3173	CAP.CHIP	63V 0.25pF 1.5pF	5322 126 10225
C 3176	CAP.CHIP	63V 0.25pF 1.5pF	5322 126 10225
C 3203	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3231	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 3232	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3233	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3234	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 3251	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 3271	CAP.CHIP	63V 0.25pF 1.5pF	5322 126 10225
C 3272	CAP.CHIP	63V 5% 470pF	5322 122 32268
C 3273	CAP.CHIP	63V 0.25pF 1.5pF	5322 126 10225
C 3276	CAP.CHIP	63V 0.25pF 1.5pF	5322 126 10225
C 3412	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 3416	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3417	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3418	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3419	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3421	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 3422	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4001	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4002	CAP.CHIP	63V 5% 10pF	5322 122 32448
C 4003	CAP.CHIP	63V 0.25pF 1.5pF	5322 126 10225
C 4004	CAP.	-10+10% 2.2nF	5322 122 33851
C 4031	CAP.CHIP	63V 10% 4.7nF	5322 126 10223
C 4032	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 4033	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 4034	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4036	CAP.	-10+10% 2.2nF	5322 122 33851
C 4037	CAP.	-10+10% 2.2nF	5322 122 33851
C 4051	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4061	CAP.	-10+10% 2.2nF	5322 122 33851
C 4062	CAP.CHIP	63V 5% 470pF	5322 122 32268
C 4111	CAP.CHIP	63V 5% 10pF	5322 122 32448
C 4112	CAP.CHIP	63V 5% 10pF	5322 122 32448
C 4113	CAP.CHIP	63V 0.25pF 2.7pF	5322 122 31873
C 4114	CAP.CHIP	63V 0.25pF 1.8pF	5322 126 10343
C 4116	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4117	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4118	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4119	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4121	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 4122	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4123	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4124	CAP.CHIP	63V 5% 10pF	5322 122 32448
C 4126	CAP.CHIP	63V 5% 680pF	5322 126 10733
C 4163	CAP.CHIP	63V 5% 56pF	5322 122 32661
C 4201	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228

Item	Description		Ordering code
C 4202	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4203	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4204	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 4206	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4207	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 4208	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 4209	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 5001	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 5002	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 5003	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 5004	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 5007	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 5008	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 5011	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5012	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5101	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5111	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5116	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5121	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5126	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5136	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5138	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 5151	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5201	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5206	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5211	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5216	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5231	CAP.ELECTROLYT.	100V 20% 27µF	5322 124 42193
C 5232	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5236	CAP.ELECTROLYT.	100V 20% 27µF	5322 124 42193
C 5238	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5251	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5301	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5306	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5311	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5316	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5321	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5322	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5326	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5331	CAP.ELECTROLYT.	100V 20% 27µF	5322 124 42193
C 5332	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5336	CAP.ELECTROLYT.	100V 20% 27µF	5322 124 42193
C 5338	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5351	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5411	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5416	CAP.CHIP	63V 10% 10nF	5322 122 34098

Item	Description		Ordering code
COILS			
L 4101	COIL	0.082µH 5% TDK	5322 157 63382
L 4102	COIL	0.082µH 5% TDK	5322 157 63382
L 4103	COIL	1µH 5% TDK	5322 157 63648
L 5231	COIL	1µH 5% TDK	5322 157 63648
L 5236	COIL	1µH 5% TDK	5322 157 63648
L 5331	COIL	1µH 5% TDK	5322 157 63648
L 5336	COIL	1µH 5% TDK	5322 157 63648
INTEGRATED CIRCUITS			
D 1001	INTEGR.CIRCUIT	OQ0230 FINAL Y	5322 209 12467
D 2001	INTEGR.CIRCUIT	OQ0229 FINAL X-Z	5322 209 12459
D 3001	INTEGR.CIRCUIT	OQ0229 FINAL X-Z	5322 209 12459
N 1001	INTEGR.CIRCUIT	TDA8444AT/N2 PEL	5322 209 30233
N 1002	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 1003	INTEGR.CIRCUIT	LM324M NSC	5322 209 61473
N 1004	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N 2002	INTEGR.CIRCUIT	TDA8444AT/N2 PEL	5322 209 30233
N 2003	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N 5131	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
RESISTORS			
R 1001	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1002	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1003	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1004	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1005	RES.CHIP	RC-02H 1% 196E	4822 051 51961
R 1006	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 1007	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1008	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1009	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1010	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 1011	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1012	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1013	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1014	RES.CHIP	RC-02H 1% 422E	4822 051 54221
R 1016	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 1018	RES.MET.GLAZED	RMC1/8 1% 46E4	5322 116 82896
R 1019	RES.MET.GLAZED	RMC1/8 1% 46E4	5322 116 82896
R 1022	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 1023	RES.CHIP	RC-02H 1% 422E	4822 051 54221
R 1024	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1027	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1029	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 1031	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 1032	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1034	RES.CHIP	RC-02H 1% 13K3	4822 051 51333

Item	Description		Ordering code
R 1036	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 1037	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 1038	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 1039	RES.CHIP	RC-02H 1% 147E	4822 051 51471
R 1041	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 1042	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 1043	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1044	RES.CHIP	RC-02H 1% 162K	4822 051 51624
R 1046	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1047	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1048	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1049	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1051	RES.CHIP	RC-02H 1% 23K7	4822 051 52373
R 1053	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 1059	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1061	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1063	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 1064	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1066	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1071	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 1072	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 1073	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 1074	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 1076	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 1077	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 1078	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1079	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1081	RES.CHIP	RC-02H 1% 464E	4822 051 54641
R 1082	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1083	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1084	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1086	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1087	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1088	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1089	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 1091	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 1201	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1202	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1203	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1204	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1206	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1207	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1208	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 1209	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 1303	RES.CHIP	RC-02H 1% 162K	4822 051 51624
R 1304	RES.CHIP	RC-02H 1% 162K	4822 051 51624
R 1306	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 1307	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 1308	RES.CHIP	RC-02H 1% 28K7	4822 051 52873
R 1309	RES.CHIP	RC-02H 1% 750E	4822 051 57501

Item	Description		Ordering code
R 1311	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1312	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1313	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 2001	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 2002	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 2003	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 2004	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2006	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2007	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 2008	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 2009	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 2011	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 2012	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2013	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 2014	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 2015	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 2016	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2017	RES.CHIP	RC-02H 1% 316K	4822 051 53164
R 2018	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 2020	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 2021	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 2023	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 2024	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 2026	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 2063	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 2064	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 2065	RES.CHIP	RC-02H 1% 2K87	4822 051 52872
R 2066	RES.CHIP	RC-02H 1% 2K87	4822 051 52872
R 2067	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2068	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2101	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2102	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2103	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2104	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 2107	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 2111	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2112	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 2114	RES.CHIP	RC-01 1% 6E8	4822 051 10688
R 2131	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2132	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 2133	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 2134	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 2136	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 2137	RES.CHIP	RC-02H 1% 110E	4822 051 51101
R 2138	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 2151	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2161	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 2171	RES.METAL FILM	MRS25 1% 11K	4822 050 21103
R 2172	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 2176	RES.CHIP	RC-02H 1% 215K	4822 051 52154

Item	Description		Ordering code
R 2177	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2201	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2202	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2203	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 2204	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 2207	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 2211	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2212	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 2214	RES.CHIP	RMC1/8 1% 6E8	4822 051 10688
R 2231	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 2232	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 2233	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 2234	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 2236	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 2237	RES.CHIP	RC-02H 1% 110E	4822 051 51101
R 2238	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 2251	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2261	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 2271	RES.METAL FILM	MRS25 1% 11K	4822 050 21103
R 2272	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 2276	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2277	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2301	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2302	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2303	RES.CHIP	RC-02H 1% 61K9	4822 051 56193
R 2304	RES.CHIP	RC-02H 1% 61K9	4822 051 56193
R 2306	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 2307	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 2308	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 2309	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 2311	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 2312	RES.CHIP	RC-02H 1% 28K7	4822 051 52873
R 2313	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 2411	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 2412	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 2416	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 2418	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 2419	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 2421	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2422	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 2423	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 3001	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 3002	RES.CHIP	RC-02H 1% 11K	4822 051 51103
R 3003	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 3004	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3006	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3007	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3008	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3009	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 3011	RES.CHIP	RC-02H 1% 11K	4822 051 51103

Item	Description		Ordering code
R 3012	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 3013	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 3014	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 3015	RES.CHIP	RC-02H 1% 28K7	4822 051 52873
R 3018	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 3021	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 3024	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3026	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 3063	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3064	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 3066	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 3067	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 3068	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3069	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3101	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3102	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3103	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3104	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 3107	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 3111	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3112	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 3114	RES.CHIP	RC-01 5% 6E8	4822 051 10688
R 3131	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3132	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 3133	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 3134	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 3136	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 3137	RES.CHIP	RC-02H 1% 110E	4822 051 51101
R 3138	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 3151	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3161	RES.CHIP	RMC1/8 1% 42K2	4822 111 91887
R 3171	RES.METAL FILM	MRS25 1% 11K	4822 050 21103
R 3176	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 3201	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3202	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3203	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3204	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 3207	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 3211	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3212	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 3214	RES.CHIP	RC-01 5% 6E8	4822 051 10688
R 3231	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 3232	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 3233	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 3234	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 3236	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 3237	RES.CHIP	RC-02H 1% 110E	4822 051 51101
R 3238	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 3251	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3261	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887

Item	Description		Ordering code
R 3271	RES.METAL FILM	MRS25 1% 11K	4822 050 21103
R 3276	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 3301	RES.CHIP	RC-02H 1% 61K9	4822 051 56193
R 3302	RES.CHIP	RC-02H 1% 11K	4822 051 51103
R 3311	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 3312	RES.CHIP	RC-02H 1% 2K87	4822 051 52872
R 3313	RES.CHIP	RC-02H 1% 2K87	4822 051 52872
R 3314	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 3316	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 3411	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 3412	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 3416	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3418	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 3419	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 3421	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3422	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 3423	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 4001	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 4002	RES.HI-TENSION	VR25 5% 3M3	4822 053 20335
R 4003	RES.HI-TENSION	VR25 5% 3M3	4822 053 20335
R 4004	RES.HI-TENSION	VR25 5% 3M3	4822 053 20335
R 4006	RES.HI-TENSION	VR25 5% 6M8	4822 053 20685
R 4007	RES.HI-TENSION	VR25 5% 6M8	4822 053 20685
R 4008	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 4009	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 4031	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 4032	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 4033	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 4034	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 4036	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 4037	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 4038	RES.CHIP	RC-02H 1% 681E	4822 051 56811
R 4039	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 4040	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 4041	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 4042	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 4043	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 4044	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 4051	RES.HI-TENSION	VR25 5% 3M3	4822 053 20335
R 4111	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 4112	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 4113	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 4114	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 4116	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4117	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4118	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 4119	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 4121	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 4122	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 4123	RES.CHIP	RC-02H 1% 422E	4822 051 54221

Item	Description		Ordering code
R 4124	RES.CHIP	RC-02H 1% 422E	4822 051 54221
R 4126	RES.CHIP	RC-02H 1% 287E	4822 051 52871
R 4127	RES.CHIP	RC-02H 1% 287E	4822 051 52871
R 4128	RES.CHIP	RC-02H 1% 162E	4822 051 51621
R 4129	RES.CHIP	RC-02H 1% 162E	4822 051 51621
R 4132	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 4133	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 4134	RES.CHIP	RMC1/8 1% 14E7	4822 111 91886
R 4136	RES.CHIP	RMC1/8 1% 14E7	4822 111 91886
R 4137	RES.CHIP	RMC1/8 1% 14E7	4822 111 91886
R 4138	RES.CHIP	RMC1/8 1% 14E7	4822 111 91886
R 4139	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 4141	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 4142	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 4143	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 4144	RES.CHIP	RMC1/8 1% 31E6	5322 116 82895
R 4146	RES.CHIP	RMC1/8 1% 31E6	5322 116 82895
R 4147	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 4148	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 4149	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 4151	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 4152	RES.CHIP	RMC1/8 1% 14E7	4822 111 91886
R 4153	RES.CHIP	RMC1/8 1% 14E7	4822 111 91886
R 4154	RES.CHIP	RC-02H 1% 681E	4822 051 56811
R 4155	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 4156	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 4157	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 4158	RES.CHIP	RC-02H 1% 121E	4822 051 51211
R 4159	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4160	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 4161	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 4162	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 4163	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 4164	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 4166	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 4167	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 4168	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 4169	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 4171	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 4181	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 4182	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 4201	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 4202	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 4203	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 4261	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 4262	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 5001	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5002	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5003	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5004	RES.CHIP	RC-01 5% 1E	4822 051 10108

Item	Description		Ordering code
R 5007	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5008	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 5101	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5111	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5116	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5121	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5126	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5131	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5132	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5133	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5134	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5136	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5137	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 5138	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 5139	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 5151	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 5201	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5206	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5211	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5216	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5251	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 5301	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5306	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5311	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5316	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 5321	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5326	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 5351	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 5411	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 5416	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 5501	RES.CHIP	RC-02H 1% 1K	4822 051 51002

SEMI CONDUCTORS

V 1009	DIODE,CHIP	BBY39 PEL	5322 130 82199
V 1011	DIODE,CHIP	BBY39 PEL	5322 130 82199
V 1014	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1016	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1018	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1019	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1021	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1022	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1023	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 1024	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 1026	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 1027	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 1028	DIODE,CHIP	BZX84-C6V8 PEL	5322 130 80406
V 1201	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1202	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513

Item	Description		Ordering code
V 1203	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1204	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1301	DIODE,CHIP	BZX84-C8V2 PEL	5322 130 80255
V 2061	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 2062	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 2101	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 2102	DIODE,CHIP	BZX84-C11 PEL	4822 130 81338
V 2103	DIODE,CHIP	BZX84-C11 PEL	4822 130 81338
V 2111	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 2113	TRANSISTOR	BFQ252 PEL	4822 130 62708
V 2131	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 2133	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 2132	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V 2134	TRANSISTOR	BFQ232 PEL	4822 130 62437
V 2201	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V 2202	DIODE,CHIP	BZX84-C11 PEL	4822 130 81338
V 2203	DIODE,CHIP	BZX84-C11 PEL	4822 130 81338
V 2211	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 2213	TRANSISTOR	BFQ252 PEL	4822 130 62708
V 2231	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 2232	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V 2233	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 2234	TRANSISTOR	BFQ232 PEL	4822 130 62437
V 2301	DIODE,CHIP	BZX84-C8V2 PEL	5322 130 80255
V 2413	DIODE,CHIP	BZX84-C8V2 PEL	5322 130 80255
V 2416	DIODE,CHIP	BZX84-C20 PEL	9333 882 90215
V 2421	DIODE,CHIP	BZX84-C6V8 PEL	5322 130 80406
V 3001	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 3002	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 3061	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 3062	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 3101	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V 3102	DIODE,CHIP	BZX84-C11 PEL	4822 130 81338
V 3103	DIODE,CHIP	BZX84-C11 PEL	4822 130 81338
V 3111	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 3113	TRANSISTOR	BFQ252 PEL	4822 130 62708
V 3131	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 3132	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V 3133	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 3134	TRANSISTOR	BFQ232 PEL	4822 130 62437
V 3136	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 3137	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 3201	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V 3202	DIODE,CHIP	BZX84-C11 PEL	4822 130 81338
V 3203	DIODE,CHIP	BZX84-C11 PEL	4822 130 81338
V 3211	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383
V 3213	TRANSISTOR	BFQ252 PEL	4822 130 62708
V 3231	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 3232	TRANSISTOR,CHIP	BF840 PEL	4822 130 60887
V 3233	TRANSISTOR,CHIP	BF824 PEL	4822 130 60383

Item	Description		Ordering code
V 3234	TRANSISTOR	BFQ232 PEL	4822 130 62437
V 3236	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 3237	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 3301	TRANSISTOR,CHIP	BF820 PEL	5322 130 62802
V 3311	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 3312	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 3413	DIODE,CHIP	BZX84-C8V2 PEL	5322 130 80255
V 3416	DIODE,CHIP	BZX84-C20 PEL	9333 882 90215
V 3421	DIODE,CHIP	BZX84-C6V8 PEL	5322 130 80406
V 4001	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 4002	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V 4003	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V 4004	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V 4031	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V 4032	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V 4033	TRANSISTOR,CHIP	BF820 PEL	5322 130 62802
V 4034	TRANSISTOR,CHIP	BF820 PEL	5322 130 62802
V 4036	DIODE,CHIP	BZX84-B24 PEL	4822 130 82709
V 4037	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 4038	TRANSISTOR,CHIP	BF820 PEL	5322 130 62802
V 4039	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V 4040	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 4041	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 4042	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 4043	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 4044	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 4101	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 4102	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 4103	TRANSISTOR,CHIP	BFR92 PEL	4822 051 52871
V 4104	TRANSISTOR,CHIP	BFR92 PEL	4822 051 52871
V 4106	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 4107	TRANSISTOR,CHIP	BFT92 PEL	5322 130 44711
V 4108	TRANSISTOR,CHIP	BFG35 PEL	5322 130 62805
V 4109	TRANSISTOR,CHIP	BFG35 PEL	5322 130 62805
V 4111	TRANSISTOR,CHIP	BFG55 PEL	5322 130 62806
V 4112	TRANSISTOR,CHIP	BFG55 PEL	5322 130 62806
V 4113	DIODE,CHIP	BBY62 PEL	5322 130 82685
V 4114	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 5001	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 5002	DIODE,CHIP	BAS21 PEL	4822 130 33702

CONNECTORS AND SOCKETS

X 2101	CONNECTOR	4-P SNG RT.ANG	5322 265 30907
X 2301	CONNECTOR	26-P DBL STRGHT	4822 267 50668
X 2402	CONNECTOR	3-P SNG RT.ANG	5322 265 30433
X 2403	SOCKET	55595 PEL	5322 255 40502
X 2411	CONNECTOR	26-P DBL STRGHT	4822 267 50558
X 2501	CONNECTOR	50-P DBL STRGHT	5322 265 61242

5.3 MICROPROCESSOR A3

5.3.1 Description A3

Introduction

The unit can be seen as the heart of the oscilloscope. It controls all oscilloscope functions and receives input signals from the following sources:

- the rotary and push button knobs present at front unit A4 and CRT controls unit A5.
- commands from an external computer that are applied to the RS232 interface that is part of microprocessor D1001.
- circuits throughout the oscilloscope indicating the state of the circuitry.
- commands from an external computer that are applied via the optional IEEE-488 interface. This interface is also located on unit A3.

Control signals coming from the microprocessor unit can be split up as follows:

- serial data that is applied to numerous digital-to-analog converters that control the continuous oscilloscope functions.
- serial data that is applied to latches that control "on/off" oscilloscope functions.
- 16 analog output voltages that control continuously variable "potentiometer" functions in the oscilloscope.

Diagram 1

The microprocessor system is formed by microprocessor D1001, FlashROM D1013 and RAM D1012. FlashROM D1015 is used for instrument extensions such as digital signal storage and processing. Amongst other features the processor incorporates 8 analog "ADC" inputs (ACH0 ... ACH7), a RS232 interface (CPTXD, CPRXD, CPDTR, CPRTS, CPCTS, CPDSR) and a I2C bus (SDAUP/SDA, SCLUP/SCL). Via the I2C bus structure many control buffers and digital-to-analog converters are loaded with data. D1001 has a 12 MHz clock with crystal G1001 that is connected between pin 8 and 9. Half the clock frequency is available as CPCLOCK at output pin 7. The 8 analog ADC inputs ACH0 ... ACH7 are used for the autocal function (YCAL and XCAL) and probe identification (PTEST-XA). These inputs are also used for temperature measurement (R1009) and time base status indication (signal TBSMART). The outputs PRMUX0 through PRMUX2 are used for the probe detection circuit on the next diagram.

D1011 demultiplexes the combined address and databits CPAD00 through CPAD07. The output consists of address-information only. Address information is present on the address/data bus if input ALE-HT is high.

The output latch D1017 creates the enable signals for the I2C bus latches and digital-to-analog converters that control the circuits throughout the oscilloscope.

Signal POWER-HT is low the first 250 ms after switching-on. This results via the gates D1007 in a low signal CPRESET-LT that initializes the microprocessor D1001. RESET-LT resets a number of chips at the unit A3 and also front unit A4. Signal EA is made high; this has the result that the microprocessor can only reach its internal ROM. This ROM incorporates the start-up routine. The routine ends by applying signal CPRSTCSLT to pin 11 of flipflop D1014. This makes signal EA low and the microprocessor can reach the FLASHROM D1013.

D1009 is a PAL that makes the selection for various chips on the unit. Examples are D1012 RAM selection via RAMCS-LT (pin 19) that results in RCS-LT via gate D1018. D1018 also generates the write pulse WRROM-LT for D1013. D1013 EPROM selection occurs via D1009 output signal ROM0CSLT. D1015 EPROM selection occurs via D1009 output signal ROM1CSLT.

D1016 is a 3 to 8 decoder that controls circuits on unit A3. Depending on the state of the 3 inputs CPA04 through CPA06, one of the 8 outputs is low at a time.

Diagram 2

The resistance value of the indication ring in the probe at channels 1, 2, 3 and 4 is present between ground and pin 13, 14, 15 and 12 of multiplexer D1008 respectively. The analog probe resistance value results in a certain DC voltage that is switched to ADC input PTEST-XA of the processor D1001.

The circuit part indicated with 'RS232-C INTERFACE' consists of a buffer D1302 that converts the microprocessor's TTL signals (0 and 5 volt) into -12 and +12 volt RS232 output levels. The buffer D1301 does the same in the opposite direction.

The buzzer circuit incorporates an oscillator built around the buffer D1301 and amplifier D1302. D1302 is enabled by flipflop D1102. The buzzer H1001 is a piezo ceramic transducer.

The +5 V reference voltage for the A.D.C.'s inside D1001 is derived from the instrument's +10 V reference voltage via operational amplifier N1801.

Diagram 3

This diagram shows the "DAC-POT" IC D1112 that converts the digital data from the microprocessor into 16 analog voltages. Each of these voltages is independently adjustable between 1 V and 4 V. The reference voltage for this D/A converter comes from N1101.

This diagram also shows the IEEE interface that is a factory-installed option. The heart of the interface is IEEE-controller D1104. The registers inside D1104 can be controlled by microprocessor D1001 via the buffer D1103. The clock for D1104 is generated by crystal oscillator G1111, D1101 and divider stage D1102. The bidirectional buffers D1107, D1108, D1109, D1111 form an interface between D1004 and the IEEE bus devices outside the oscilloscope. D1106 controls the bidirectional buffers.

Diagram 4

Diagram 5 shows the pinning of the two connectors on microprocessor unit A3. Connector X1101 makes contact with the motherboard. Connector X1501 makes contact with the signal unit A1 via a flat cable. D1931 is a real-time clock that may be present as a factory-installed option.

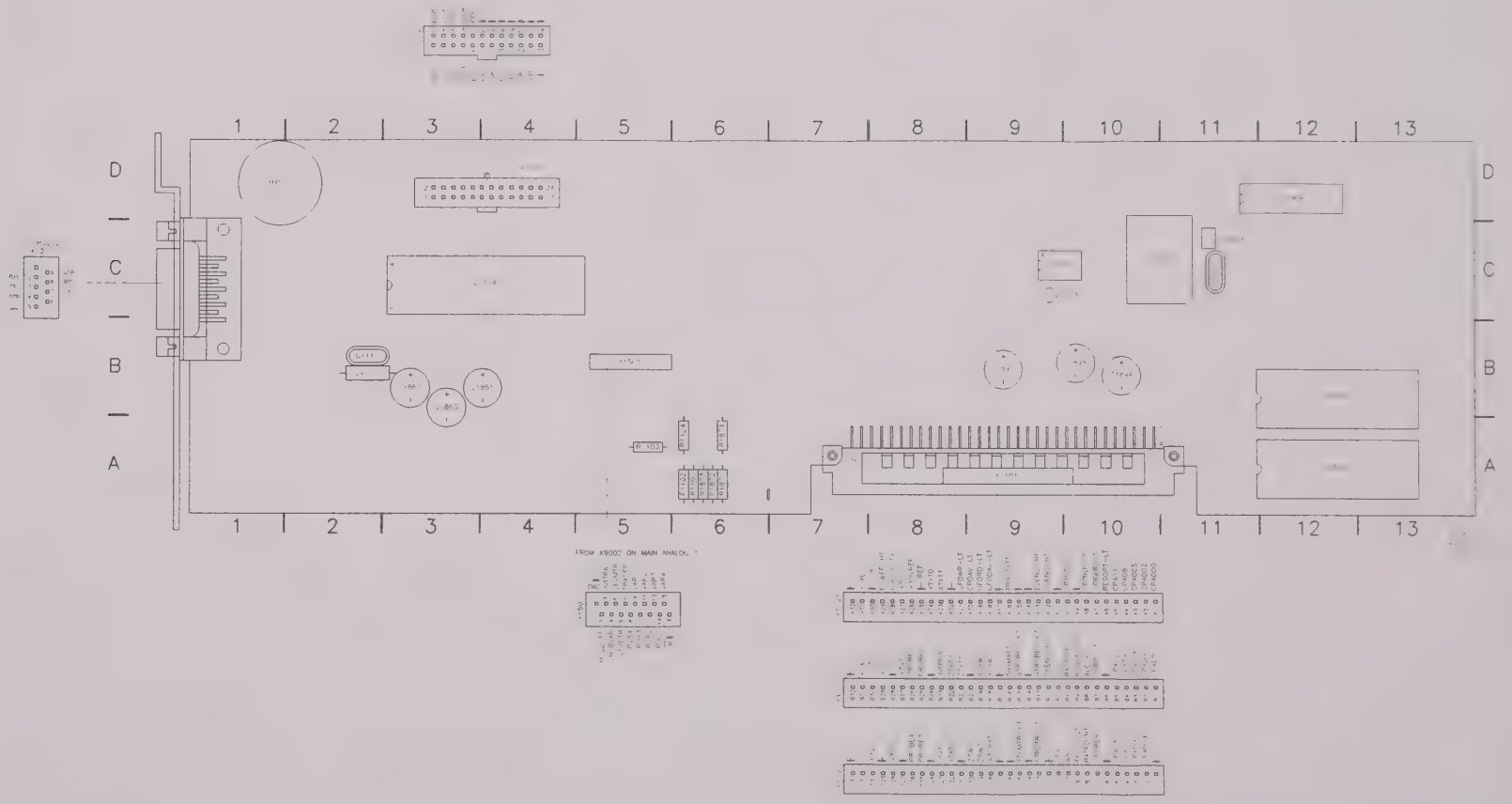
5.3.2 Signal name list A3

Note: In the signal name list you find the itemnumber of the component that is source or destination. Behind this itemnumber (separated by ":") you find the number of the diagram where the source/destination can be found (n.c. = not connected).

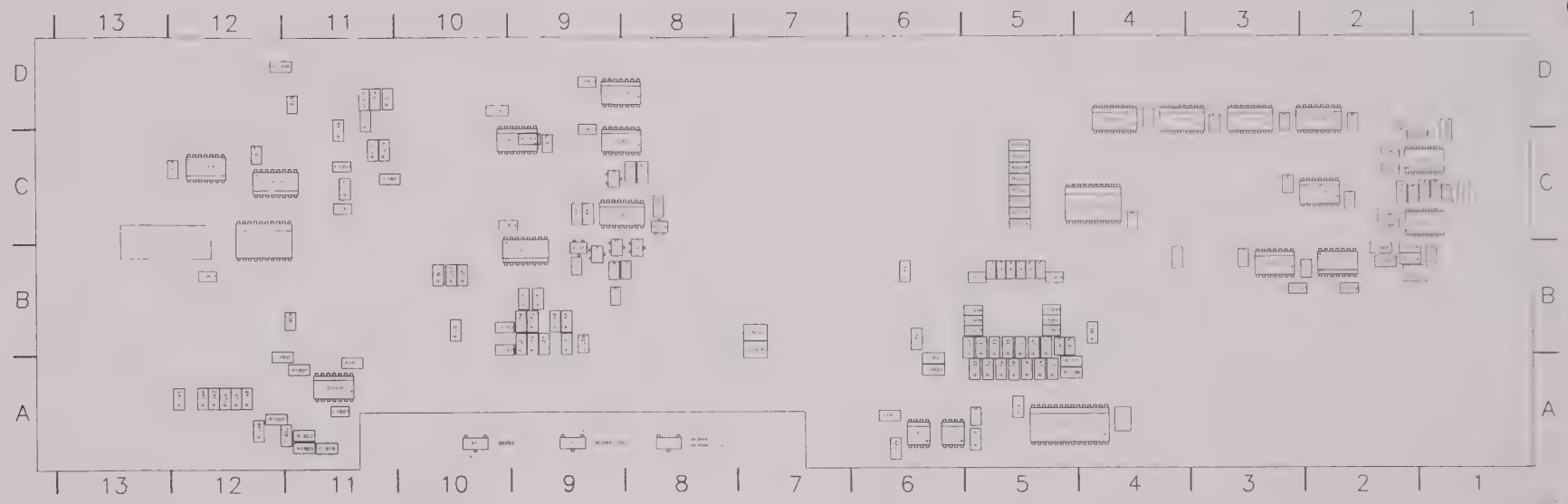
NAME	MEANING	SOURCE	DESTINATION
CPCTS	RS232 CLEAR TO SEND (TTL)	D1301:02	D1001:01
CPDSR	RS232 DATA SET READY (TTL)	D1301:02	D1001:01
CPDTR	RS232 DATA TERMINAL READY (TTL)	D1001:01	D1302:02
CPRTS	RS232 REQUEST TO SEND (TTL)	D1001:01	D1302:02
CPRXD	RS232 RECEIVE DATA (TTL)	D1301:02	D1001:01
CPTXD	RS232 TRANSMIT DATA (TTL)	D1001:01	D1302:02
DACPEN-LT	ENABLE SIGNAL FOR DACPOT CIRCUIT	D1016:01	D1112:03
DACPWR-LT	WRITE SIGNAL FOR DACPOT CIRCUIT	D1016:01	D1112:03
DLEN0-HT	DATA LATCH ENABLE 0	R1063:01	X1101:04
DLEN1-HT	DATA LATCH ENABLE 1	R1064:01	X1101:04
DLEN2-HT	DATA LATCH ENABLE 2	R1066:01	X1101:04
FOCUS-DA	DC PART FOCUSING SIGNAL	R1136:03	X1101:04
HOLDOFF	HOLD OFF CONTROL SIGNAL	R1122:03	X1501:04
INTTRA	TRACE INTENSITY CONTROL SIGNAL	R1123:03	X1501:04

MTBVAR	MAIN TB VAR CONTROL SIGNAL	R1124:03	X1501:04
LEVDTB	DELAYED TB LEVEL CONTROL SIGNAL	R1126:03	X1501:04
LEVMTB	MAIN TB LEVEL CONTROL SIGNAL	R1125:03	X1501:04
POS1	CH1 POSITION CONTROL SIGNAL	R1129:03	X1501:04
POS2	CH2 POSITION CONTROL SIGNAL	R1132:03	X1501:04
POS3	CH3 POSITION CONTROL SIGNAL	R1134:03	X1501:04
POS4	CH4 POSITION CONTROL SIGNAL	R1128:03	X1501:04
POWER-HT	POWER UP INDICATION SIGNAL	X1101:04	D1007:01
PRMUX0	PROBE READ-OUT MPX CONTROL 0	D1001:01	D1008:02
PRMUX1	PROBE READ-OUT MPX CONTROL 1	D1001:01	D1008:02
PRMUX2	PROBE READ-OUT MPX CONTROL 2	D1001:01	D1008:02
PROBE1	PROBE DETECTION/50Ω PROTECT CH1	X1101:04	V1014:02
PROBE2	PROBE DETECTION/50Ω PROTECT CH2	X1101:04	V1013:02
PROBE3	PROBE DETECTION/50Ω PROTECT CH3	X1101:04	V1012:02
PROBE4	PROBE DETECTION/50Ω PROTECT CH4	X1101:04	V1011:02
PTEST-XA	PROBE TEST SIGNAL	D1008:02	D1001:01
SCL	SERIAL CLOCK	R1054:01	X1101:04
SCLUP	SERIAL CLOCK AT MICROPROCESSOR	D1001:01	R1053:01
SDA	SERIAL DATA	R1052:01	X1101:04
SDAUP	SERIAL DATA AT MICROPROCESSOR	D1001:01	R1051:01
STROBE0-HT	STROBE/ENABLE SIGNAL 0	R1067:01	X1101:04
STROBE1-HT	STROBE/ENABLE SIGNAL 1	R1068:01	X1101:04
TBHOTXT	HOLD OFF INDICATION FOR TEXT IC	X1101:04	n.c.
TRASEP	TRACE SEPARATION CONTROL SIGNAL	R1127:03	X1501:04
UFODAVLT	FRONT WRITES TO MICROPROCESSOR	X1101:04	D1001:01
UFOWR-LT	MICROPROCESSOR WRITES TO FRONT	D1016:01	X1101:04
VAR1	CH1 VARIABLE GAIN CONTROL SIGNAL	R1135:03	X1501:04
VAR2	CH2 VARIABLE GAIN CONTROL SIGNAL	R1133:03	X1501:04
VAR3	CH3 VARIABLE GAIN CONTROL SIGNAL	R1131:03	X1501:04
VAR4	CH4 VARIABLE GAIN CONTROL SIGNAL	R1130:03	X1501:04
XCAL	SIGNAL FOR X CALIBRATION	X1101:04	D1001:01
XTXT0	HORIZONTAL TEXT SIGNAL 0	n.c.	X1101:04
XTXT1	HORIZONTAL TEXT SIGNAL 1	n.c.	X1101:04
XYSW0	X AND Y SWITCHING TEXT/SIGNAL 0	n.c.	X1101:04
XYSW1	X AND Y SWITCHING TEXT/SIGNAL 1	n.c.	X1101:04
YCAL	SIGNAL FOR Y CALIBRATION	X1101:04	D1001:01
YTXT0	VERTICAL TEXT SIGNAL 0	n.c.	X1501:04
YTXT1	VERTICAL TEXT SIGNAL 1	n.c.	X1501:04
ZSW0	Z SWITCHING TEXT/SIGNAL 0	n.c.	X1101:04
ZSW1	Z SWITCHING TEXT/SIGNAL 1	n.c	X1101:04
ZTXT0	TEXT INTENSITY 0	n.c.	X1101:04
ZTXT1	TEXT INTENSITY 1	n.c.	X1101:04

5.3.3 Unit lay-outs

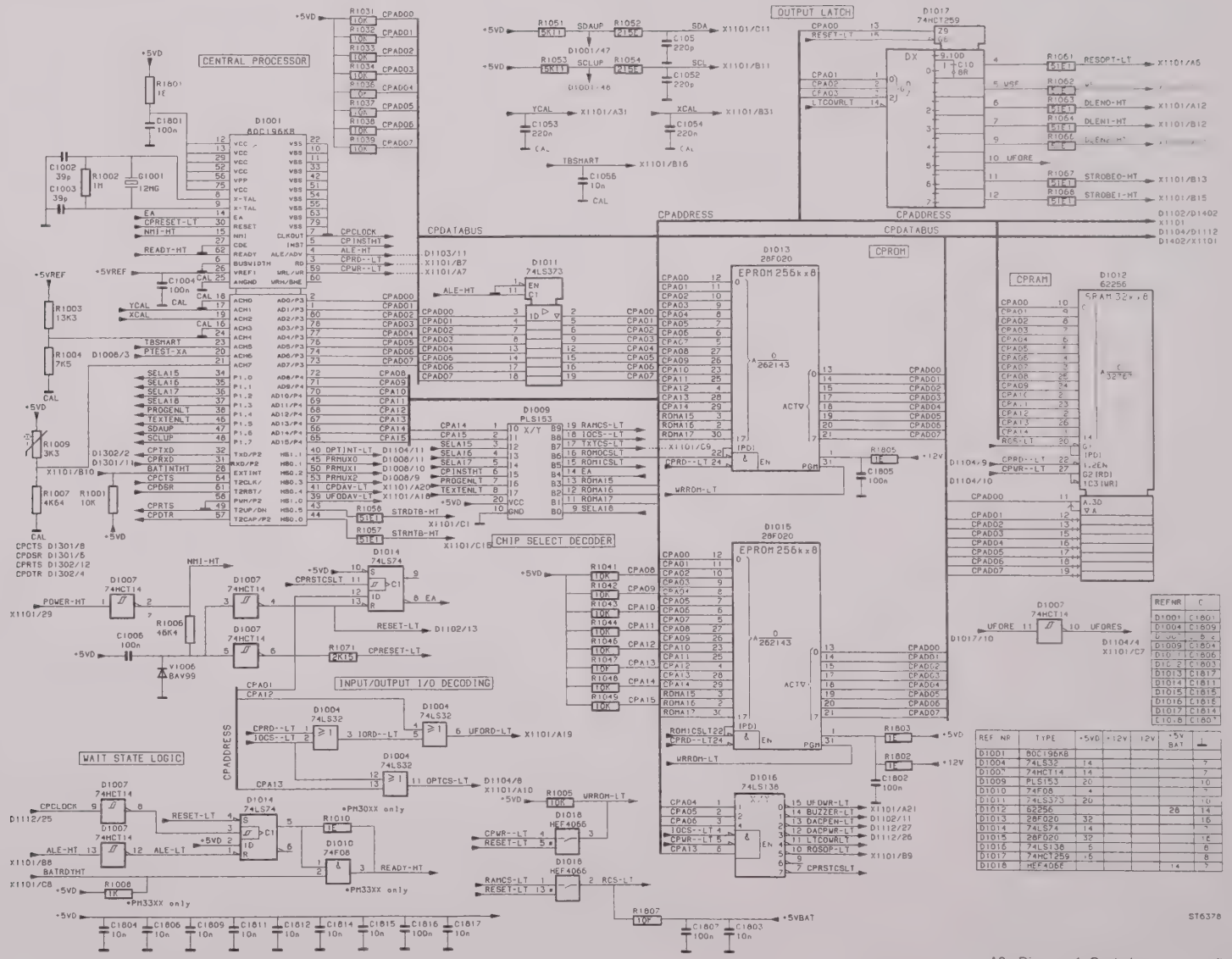


Lay-out 1 - Large component side of microprocessor unit A3

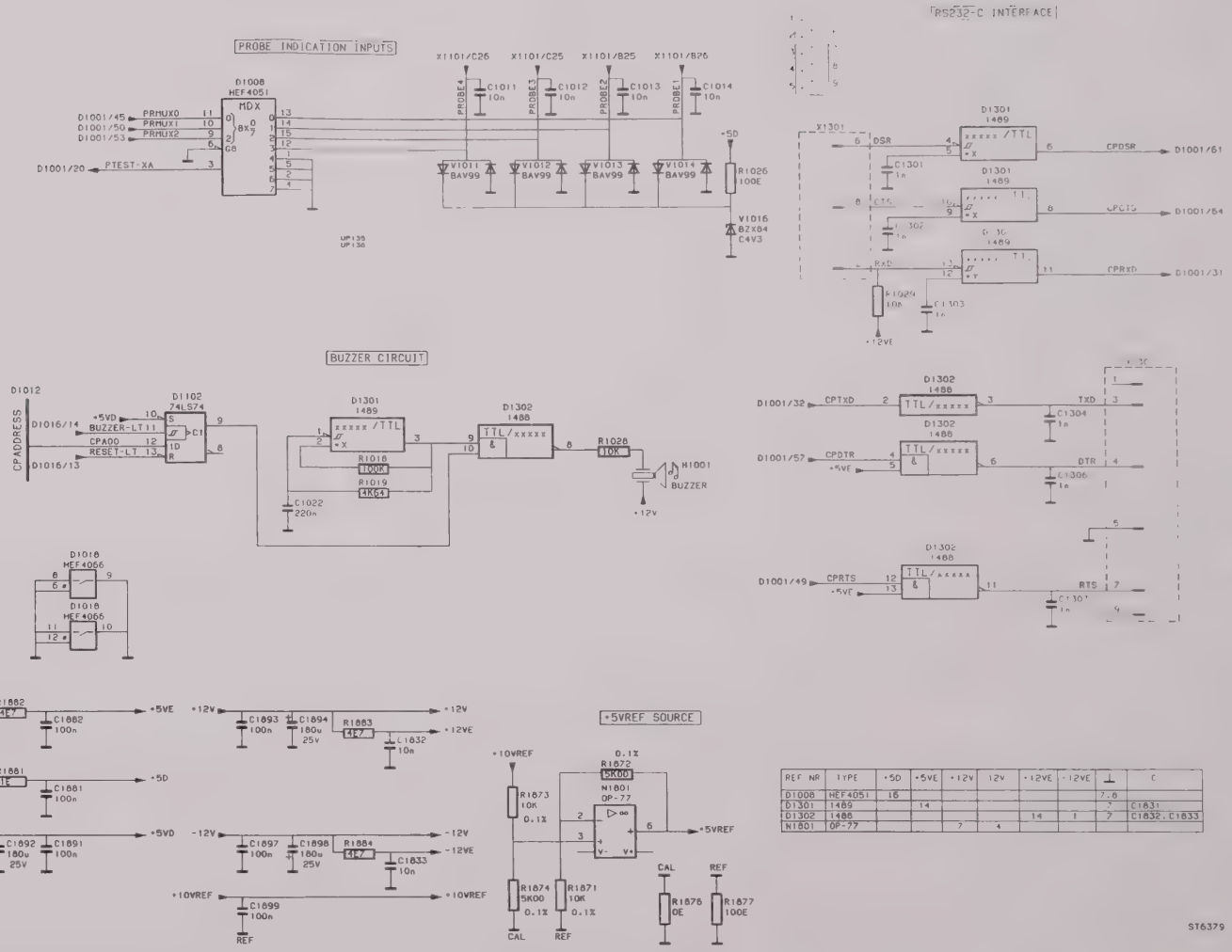


Lay-out 2 - Small component side of microprocessor unit A3

5.3.4 Circuit diagrams



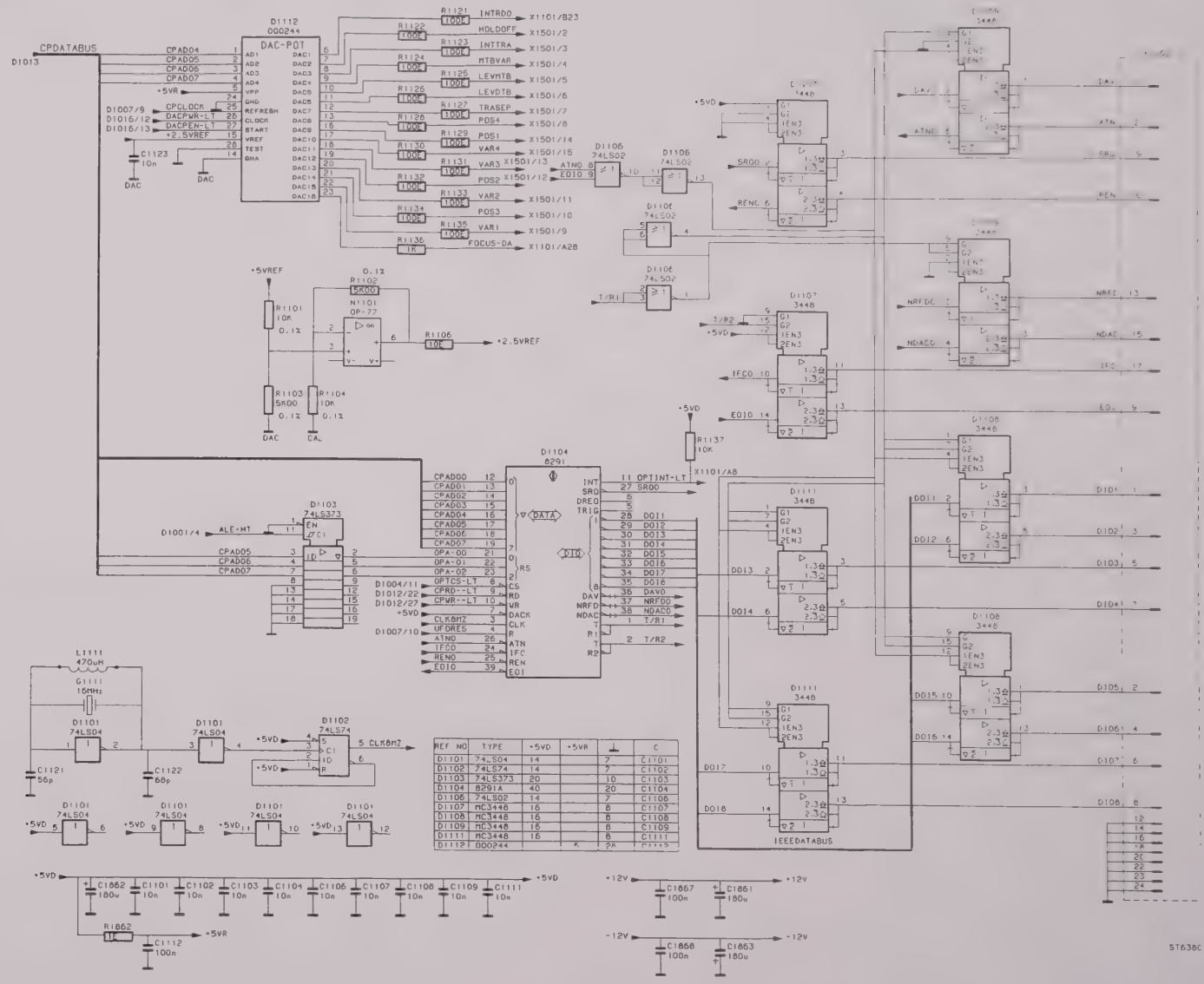
A3 - Diagram 1; Central processor unit



REF NR	TYPE	+5D	+5VE	+12V	-12V	+12VE	-12VE	⊥	C
D1008	HEF4051	16						7,8	
D1301	1489		14					7	C1831
D1302	1488					14	1	7	C1832, C1833
N1801	OP-77			7	4				

ST6379

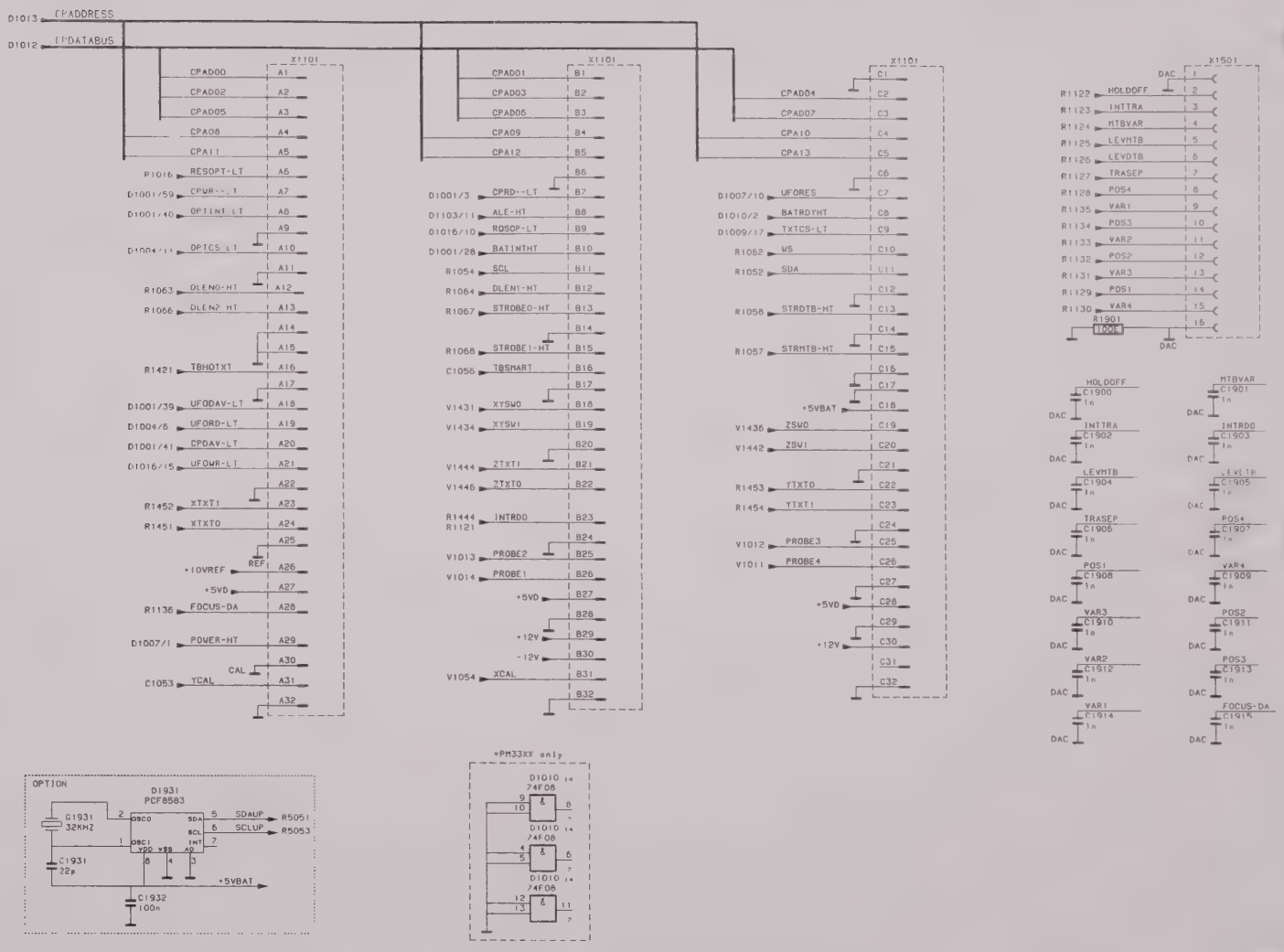
A3 - Diagram 2 ; Auxiliary circuits



REF NO	TYPE	+5VD	+5VR	⊥	C
D1101	74LS04	14		7	C1101
D1102	74LS74	14		7	C1102
D1103	74LS373	20		10	C1103
D1104	8291A	40		20	C1104
D1106	74LS02	14		7	C1106
D1107	MC3448	16		8	C1107
D1108	MC3448	16		8	C1108
D1109	MC3448	16		8	C1109
D1111	MC3448	16		8	C1111
D1112	000244			12	

ST638C

A3 - Diagram 3 ; Potentiometer DAC and IEEE-option



ST6382

A3 - Diagram 4 ; Text and cursor circuit

5.3.5 Parts list

CAPACITORS

Item	Description		Ordering code
C 1002	CAP.CERAMIC	63V 5% 39pF	5322 122 32966
C 1003	CAP.CERAMIC	63V 5% 39pF	5322 122 32966
C 1004	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1006	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1011	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1012	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1013	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1014	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1022	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 1051	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 1052	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 1053	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 1054	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 1056	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1102	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1112	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 1123	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1301	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 1302	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 1303	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 1304	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 1306	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 1307	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 1801	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1802	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1803	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1804	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1805	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1806	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1807	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1809	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1811	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1812	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1814	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1815	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1816	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1817	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1832	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1833	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1867	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1868	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1881	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1882	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1891	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1892	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228

Item	Description		Ordering code
C 1893	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1894	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 1897	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1898	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 1899	CAP.CHIP	63V 10% 100nF	4822 122 33496

INTEGRATED CIRCUITS

D 1004	INTEGR.CIRCUIT	N74LS32D PEL	5322 209 73968
D 1007	INTEGR.CIRCUIT	PC74HCT14T PEL	5322 209 71568
D 1008	INTEGR.CIRCUIT	HEF4051BT PEL	5322 209 11446
D 1009	I.C. ROM	PLS153AN-PROG	5322 209 52095
D 1009	INTEGR.CIRCUIT	PLS153AN PEL	5322 209 60478
D 1010	INTEGR.CIRCUIT	N74F08D PEL	5322 209 61002
D 1011	INTEGR.CIRCUIT	N74LS373D PEL	5322 209 60178
D 1012	INTEGR.CIRCUIT	56LFP-10TZU HIT	5322 209 30228
D 1013	INTEGR.CIRCUIT	P28F010-150 (*!)	5322 209 30267

(*!): This FLASH-ROM is EMPTY and must be loaded with operating and calibration software. Refer to chapter 8.9.2 for further information.

D 1014	INTEGR.CIRCUIT	N74LS74AD PEL	5322 209 60993
D 1016	INTEGR.CIRCUIT	N74LS138D PEL	5322 209 61478
D 1017	INTEGR.CIRCUIT	PC74HCT259T PEL	4822 209 30086
D 1018	INTEGR.CIRCUIT	HEF4066BT PEL	5322 209 14542
D 1102	INTEGR.CIRCUIT	N74LS74AD PEL	5322 209 60993
D 1112	INTEGR.CIRCUIT	OQ0244	5322 209 12468
D 1301	INTEGR.CIRCUIT	MC1489ADR2	5322 209 30232
D 1302	INTEGR.CIRCUIT	MC1488D MOT	5322 209 30269
N 1101	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791
N 1801	I.C. ANALOGUE	OP-77GSR PMI	5322 130 62791

RESISTORS

R 1001	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1002	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 1003	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 1004	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 1005	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1006	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 1007	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 1008	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1009	RES.N.T.C.	NTC640 2% 3K3	5322 116 30421
R 1018	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1019	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 1026	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1028	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1029	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1031	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1032	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1033	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1034	RES.CHIP	RC-02H 1% 10K	4822 051 51003

Item	Description		Ordering code
R 1036	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1037	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1038	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1039	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1041	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1042	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1043	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1044	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1046	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1047	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1048	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1049	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1051	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1052	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 1053	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1054	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 1057	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1058	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1061	RES,CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1062	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1063	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1064	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1066	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1067	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1068	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1071	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 1101	RES.METAL FILM	1/4W 0.1% 10K	5322 116 82868
R 1102	RES.METAL FILM	1/4W 0.1% 5K	5322 116 80369
R 1103	RES.METAL FILM	1/4W 0.1% 5K	5322 116 80369
R 1104	RES.METAL FILM	1/4W 0.1% 10K	5322 116 82868
R 1106	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1121	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1122	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1123	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1124	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1125	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1126	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1127	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1128	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1129	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1130	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1131	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1132	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1133	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1134	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1135	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1136	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1137	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1801	RES.CHIP	RC-01 5% 1E	4822 051 10108

Item	Description		Ordering code
R 1802	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1805	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1807	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1862	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 1871	RES.METAL FILM	1/4W 0.1% 10K	5322 116 82868
R 1872	RES.METAL FILM	1/4W 0.1% 5K	5322 116 80369
R 1873	RES.METAL FILM	1/4W 0.1% 10K	5322 116 82868
R 1874	RES.METAL FILM	1/4W 0.1% 5K	5322 116 80369
R 1876	RES.CHIP	RC-01 0E	4822 051 10008
R 1877	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1881	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 1882	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 1883	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 1884	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 1901	RES.CHIP	RC-01 0E	4822 051 10008

SEMICONDUCTORS

V 1006	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 1011	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 1012	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 1013	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 1014	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 1016	DIODE,CHIP	BZX84-C4V3 PEL	5322 130 80256

CONNECTORS

X 1101	CONNECTOR	96-P PIN 2.54	5322 265 61238
X 1301	CONNECTOR	9-P PIN DIPS	5322 265 41143
X 1501	CONNECTOR	P 1.25MM STR	5322 267 51107

MISCELLANEOUS

G 1001	CRISTAL	CRISTAL 12MHz	5322 242 71444
H 1001	BUZZER	7EPP-4001 MUR	5322 280 10249

5.4 FRONT UNIT A4

5.4.1 Description

Diagram 1

The front unit incorporates several keys and a number of rotary knobs that are read by a microcomputer D5001. This microcomputer can communicate with the instrument's main microprocessor on unit A3 via connector X5002. The communication from front unit A4 to unit A3 occurs via buffer D5003. The communication in the opposite direction happens via buffer D5006. The flipflops D5004 are used to facilitate this communication.

If unit A3 wants to write information to front unit A4 the following occurs:
D5006 is loaded with 8 bits of information via write pulse UFOWR-LT. This pulse is also applied to flipflop D5004/11 and this makes CPDAV-LT low. This causes an interrupt for the front processor D5001. D5001 reads D5006 via the signal CPURD-LT.

If the front A4 wants to send information to A3 the following occurs:
D5003 is loaded with 8 bits of information via write pulse CPUWR-LT. This pulse is also applied to flipflop D5004/3 and this makes UFODAVLT low. This is recognized by the main microprocessor on unit A3. This device reads the contents of D5003 via signal UFORD-LT.

The rotaries and the keys are read via the 4 bit ROT-BUS and the 8 bit SW-BUS respectively. One bit in these busses is made low at a time and via the 8 bit UFOAD-BUS an 8 bit pattern is sent back to processor D5001. This bit pattern incorporates information concerning the keys/rotaries that are activated.

Diagram 2

The keys and rotaries are both grouped in a matrix. The key position is read out by making one of the SW lines low at a time. If a key is pressed, a low level is switched through to one of the 8 input lines of key latch D5002. The other lines stay at a high level via the pull-up resistors R5121 through R5129.

Each rotary can occupy 4 different states. A rotary incorporates a rotor contact that can make contact with one of the two stator contacts. It is also possible that the rotor makes no contact. The last possibility is that the rotor makes contact with both stator contacts. Most of the rotaries are present on front unit A4. Via connector X5001 the rotaries on the CRT controls unit A5 are read out. The rotaries are read out via the ROT-BUS lines RA, RB, RC and RD that are made low one at a time This results in a certain bit pattern at the input of key latch D5002. This bit pattern is read by the microprocessor via enable signal PSEN--LT.

Diodes are used throughout the key and rotary matrix to guarantee that false information is not read by the microprocessor in case more than one control is operated at a time.

5.4.2 Signal name list A4.

Note: In the signal name list you find the itemnumber of the component that is source or destination. Behind this itemnumber (separated by ":") you find the number of the diagram where the source/destination can be found.

NAME	MEANING	SOURCE	DESTINATION
PSEN-LT	READ SIGNAL FOR KNOBS AND KEYS	D5001:01	D5002:02
UFODAVLT	FRONT WRITES TO MICROPROCESSOR	D5004:01	X5002:01
UFOWR-LT	MICROPROCESSOR WRITES TO FRONT	X5002:01	D5006:01
			D5004:01

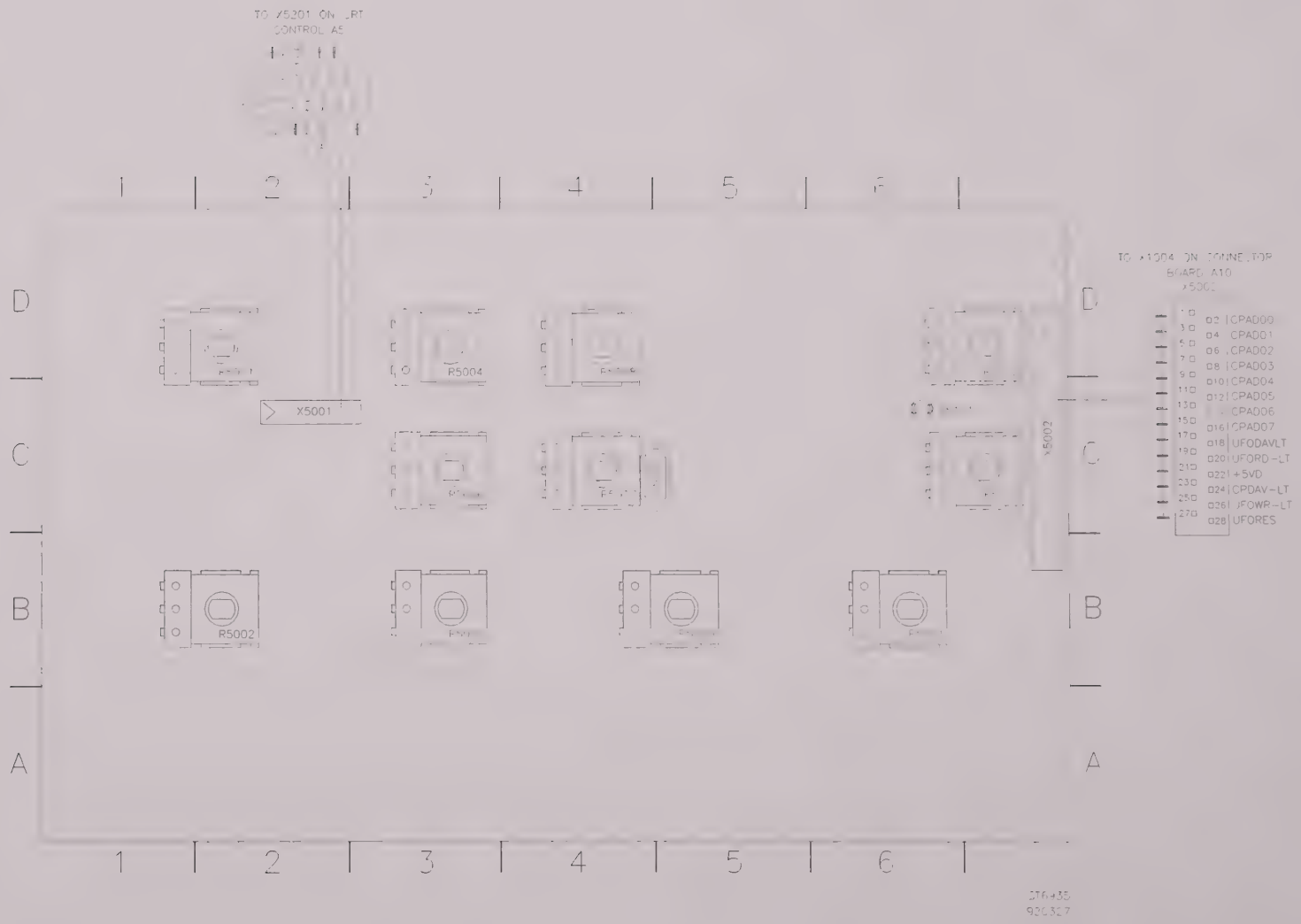
5.4.3 Key switches

Digital oscilloscopes: PM3394, PM3392, PM3384 and PM3382
Analog oscilloscopes: PM3094, PM3092, PM3084 and PM3082
Test code is obtained via the UTIL MAINTENANCE menu. Refer to section 8.11.4.2 for detailed information.

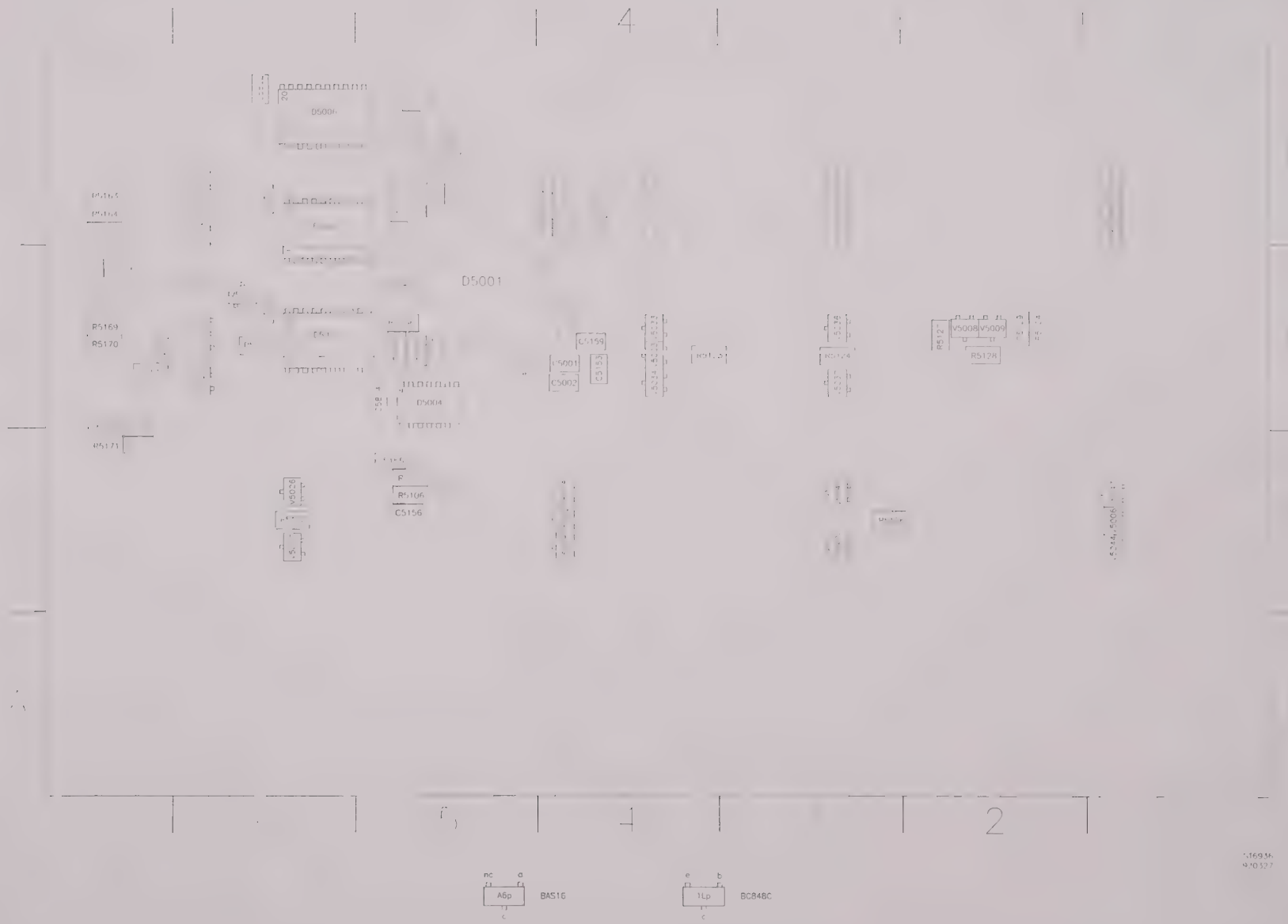
SWITCH	DIGITAL OSC.	ANALOG OSC.	TEST CODE
S5001	DISPLAY		70
S5002	MATH		60
S5003	MEASURE		50
S5004	RECALL		40
S5006	SAVE		30
S5007	DSO		20
S5008	UTIL	UTIL	10
S5009	CAL	CAL	00
S5011	PLOT		71
S5012	MAGNIFY-R	TRACE SEP-R	61
S5013	MAGNIFY-L	TRACE SEP-L	51
S5014	TRIGGER	HOR MODE	41
S5016	ACQUIRE		31
S5017	pin hole	pin hole	(21)
S5018	SETUPS	FRONTS	11
S5019	AUTO SET	AUTO SET	(01)
S5021	SINGLE	SINGLE/RESET	72
S5022	STOP		62
S5023	RUN	10x MAGN	52
S5024	CURSORS	CURSORS	42
S5026	DTB s	DTB s	32
S5027	SOFTKEY 2	SOFTKEY 2	22
S5028	SOFTKEY 1	SOFTKEY 1	12
S5029	STATUS/LOCAL	STATUS/LOCAL	02
S5031	TIME/DIV ns	MTB ns	73
S5032	TIME/DIV s	MTB s	63
S5033	TB MODE	TRIGGER MTB	53
S5034	DTB ns	DTB ns	43
S5036	MODE	DTB	33
S5037	SOFTKEY 3	SOFTKEY 3	23
S5038	SOFTKEY 4	SOFTKEY 4	13
S5039	SOFTKEY 5	SOFTKEY 5	03
S5041	AC/DC CH4	AC/DC CH4	74
S5042	INV CH4	INV CH4	64
S5043	TRIG CH4	TRIG CH4	54
S5044	AVERAGE	ALT CHOP	44
S5046		BWL	34
S5047	50Ω CH1	50Ω CH1	24
S5048	AMPL mV CH1	AMPL mV CH1	14
S5049	SOFTKEY 6	SOFTKEY 6	04

S5051	ON CH4	ON CH4	75
S5052	50Ω CH4	50Ω CH4	65
S5053	TRIG CH3	TRIG CH3	55
S5054	TRIG CH2	TRIG CH2	45
S5056	TRIG CH1	TRIG CH1	35
S5057	ON CH1	ON CH1	25
S5058	AMPL V CH1	AMPL V CH1	15
S5059	TEXT OFF	TEXT OFF	05
S5061	AMPL mV CH4	AMPL mV CH4	76
S5062	CH3+CH4	CH3+CH4	66
S5063	50Ω CH3	50Ω CH3	56
S5064	AMPL mV CH3	AMPL mV CH3	46
S5066	INV CH2	INV CH2	36
S5067	50Ω CH2	50Ω CH2	26
S5068	AMPL mV CH2	AMPL mV CH2	16
S5069	CH1+CH2	CH1+CH2	06
S5071	AMPL V CH4	AMPL V CH4	77
S5072	AC/DC CH3	AC/DC CH3	67
S5073	ON CH3	ON CH3	57
S5074	AMPL V CH3	AMPL V CH3	47
S5076	AC/DC CH2	AC/DC CH2	37
S5077	ON CH2	ON CH2	27
S5078	AMPL V CH2	AMPL V CH2	17
S5079	AC/DC CH1	AC/DC CH1	07
R5001	TRACK	TRACK	.A
R5002	POS 1	POS 1	.B
R5003	POS 2	POS 2	.3
R5004	DELTA	DELTA	.C
R5006	DELAY	LEVEL DTB	.4
R5007	TRIGGER POSITION	DELAY	.D
R5008	HOLD OFF	HOLD OFF	.5
R5009	POS 3	POS 3	.E
R5011	POS 4	POS 4	.6
R5012	X-POS	X-POS	.F
R5013	TRIGGER LEVEL	LEVEL MTB	7

5.4.4 Unit lay-outs

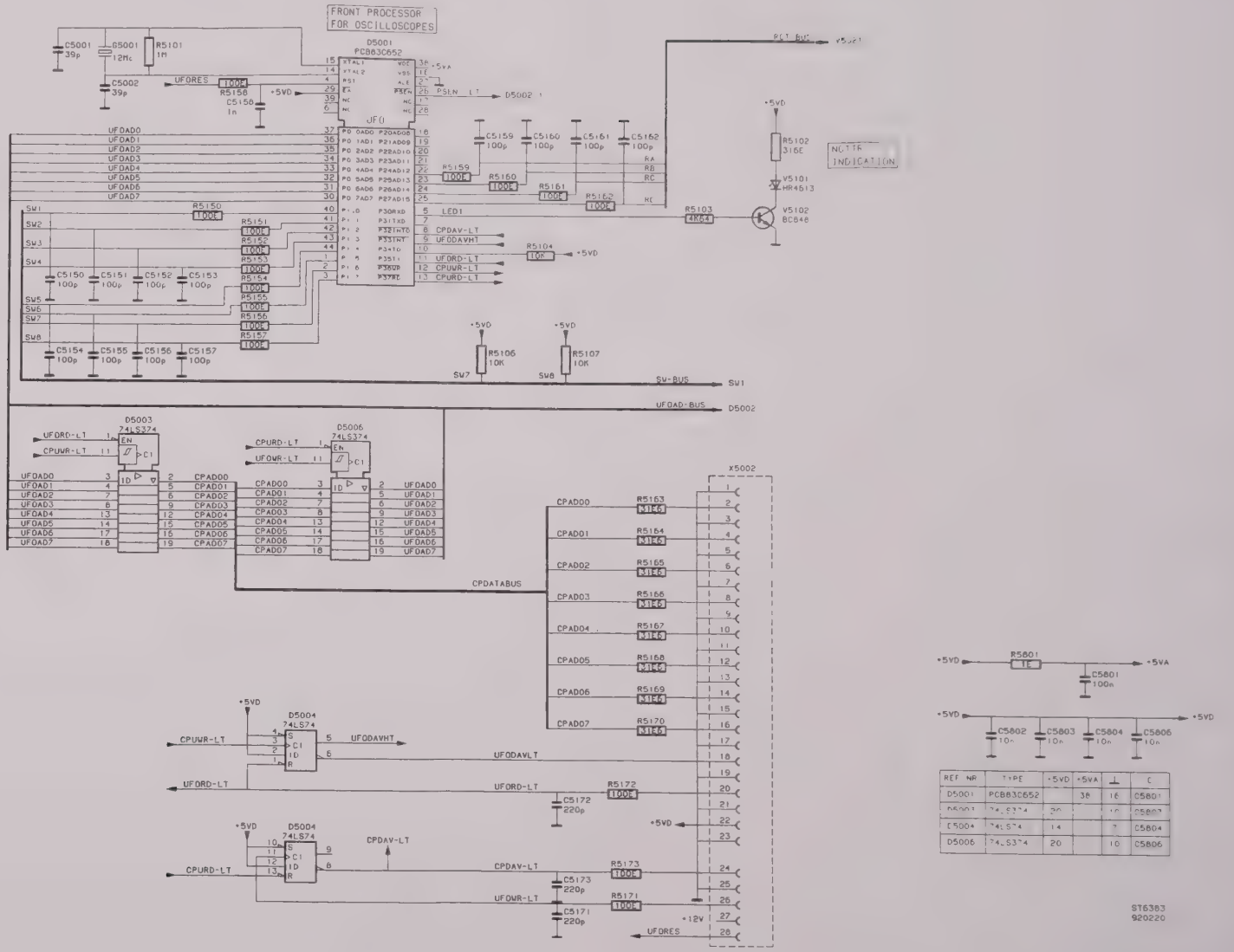


Lay-out 1 - Large component side of front unit A4



Lay-out 2 - Small component side of front unit A4

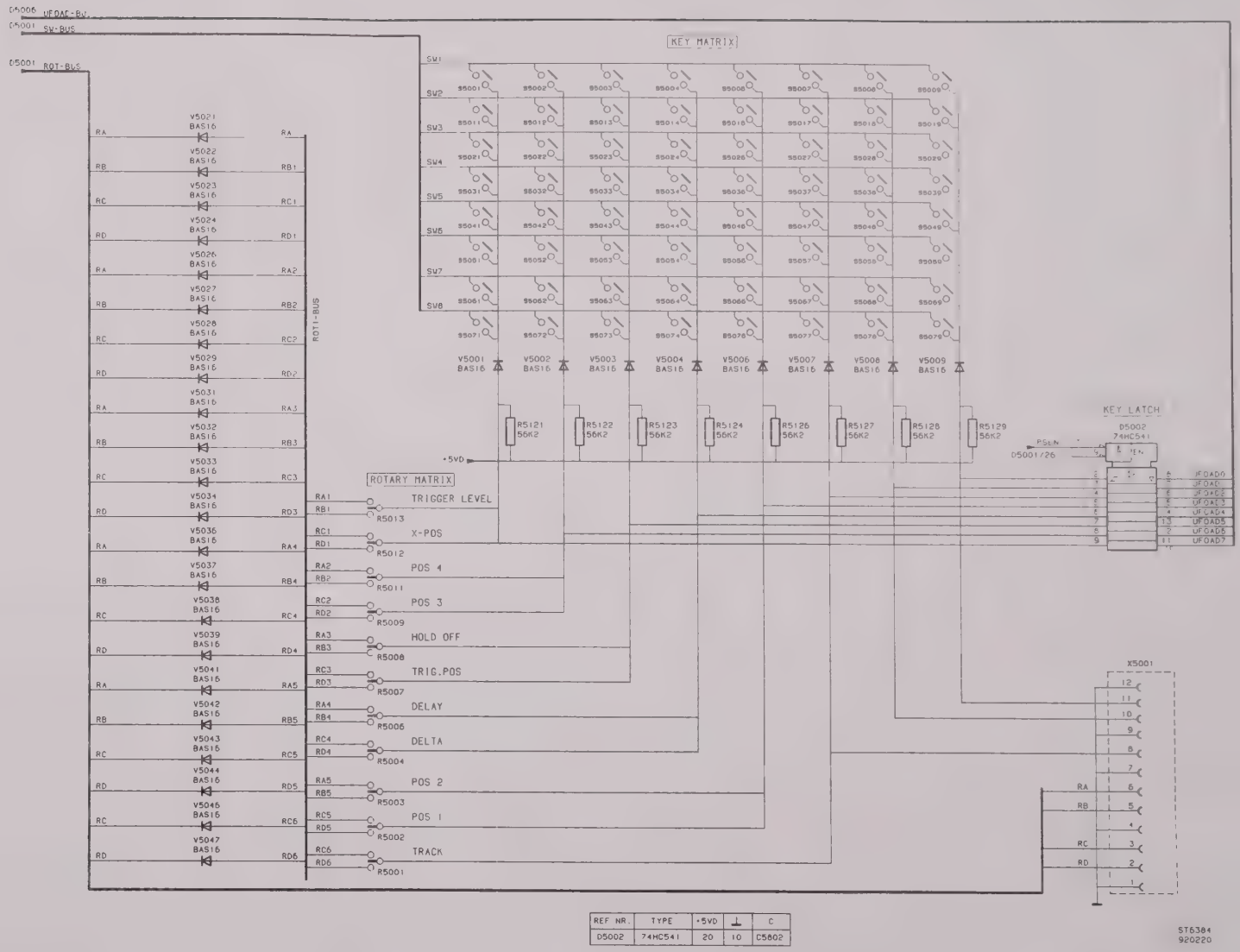
5.4.5 Circuit diagrams



REF NR	TYPE	+5VD	+5VA	⊥	C
D5001	PCB83C652		38	16	C5801
D5003	74LS374	20		10	C5802
D5004	74LS374	14		7	C5804
D5006	74LS374	20		10	C5806

ST6383
920220

A4 - Diagram 1; Front processor



REF NR.	TYPE	+5VD	⊥	C
D5002	74HC541	20	10	C5802

A4 - Diagram 2; Key matrix

5.4.6 Parts list

Item	Description		Ordering code
CAPACITORS			
C 5001	CAP.CERAMIC	63V 5% 39pF	5322 122 32966
C 5002	CAP.CERAMIC	63V 5% 39pF	5322 122 32966
C 5150	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5151	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5152	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5153	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5154	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5155	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5156	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5157	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5158	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 5159	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5160	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5161	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5162	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 5171	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 5172	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 5173	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 5801	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 5802	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5803	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5804	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 5806	CAP.CHIP	63V 10% 10nF	5322 122 34098
INTEGRATED CIRCUITS			
D 5001	INTEGR.CIRCUIT	3C652-AB023 PEL	5322 209 30272
D 5002	I.C. INTERFACE	PC74HC541T PEL	4822 209 63763
D 5003	INTEGR.CIRCUIT	N74LS374D PEL	5322 209 60995
D 5004	INTEGR.CIRCUIT	N74LS74AD PEL	5322 209 60993
D 5006	INTEGR.CIRCUIT	N74LS374D PEL	5322 209 60995
MISCELLANEOUS			
G 5004	CERAM FILTER	12MHZ KYO	5322 242 71444
H 5101	LED	TLHR4613 AEG	5322 130 81522
ROTARY SWITCHES			
R 5001	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5002	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5003	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5004	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5006	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036

Item	Description		Ordering code
R 5007	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5008	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5009	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5011	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5012	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5013	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036

RESISTORS

R 5101	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 5102	RES.CHIP	RC-02H 1% 316E	4822 051 53161
R 5103	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 5104	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5106	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5107	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 5121	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 5122	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 5123	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 5124	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 5126	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 5127	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 5128	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 5129	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 5150	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5151	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5152	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5153	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5154	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5155	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5156	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5157	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5158	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5159	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5160	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5161	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5162	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5163	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5164	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5165	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5166	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5167	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5168	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5169	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5170	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 5171	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5172	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5173	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 5801	RES.CHIP	RC-01 5% 1E	4822 051 10108

Item	Description		Ordering code
SEMICONDUCTORS			
V 5001	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5002	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5003	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5004	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5006	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5007	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5008	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5009	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5021	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5022	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5023	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5024	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5026	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5027	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5028	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5029	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5031	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5032	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5033	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5034	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5036	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5037	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5038	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5039	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5041	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5042	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5043	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5044	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5046	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5047	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 5102	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
CONNECTORS			
X 5001	CONNECTOR	P 1.25MM STR	4822 267 50668
X 5002	CONNECTOR	P 1.25MM STR	5322 267 60311

5.5 CRT CONTROLS UNIT A5

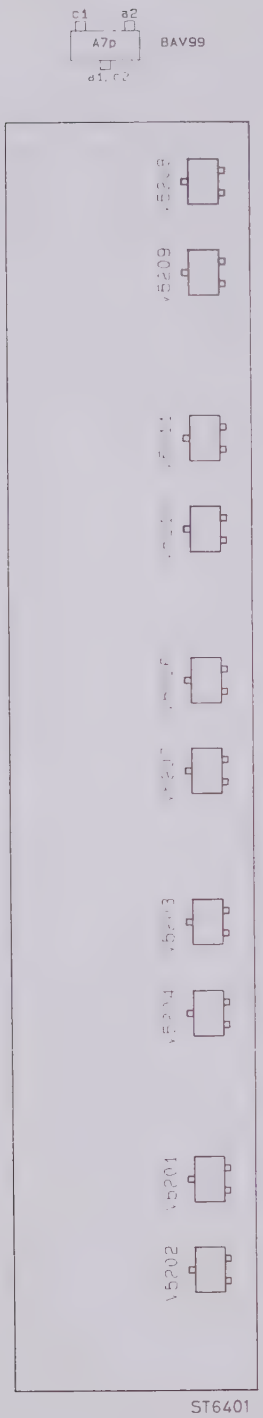
5.5.1 Description

Each rotary can occupy 4 different states. A rotary incorporates a rotor contact that can make contact with one of the two stator contacts. It is also possible that the rotor makes no contact. The last possibility is that the rotor makes contact with both stator contacts. Most of the rotaries are present on front unit A4. Via connector X5201 the rotaries on the CRT controls unit A5 are read out. The rotaries are read out via the ROT-BUS lines RA, RB, RC and RD that are made low one at a time. This results in a certain bit pattern at the input of key latch D5002 on unit A4. This bit pattern is read by the microprocessor via enable signal PSEN--LT from the front processor on unit A4.

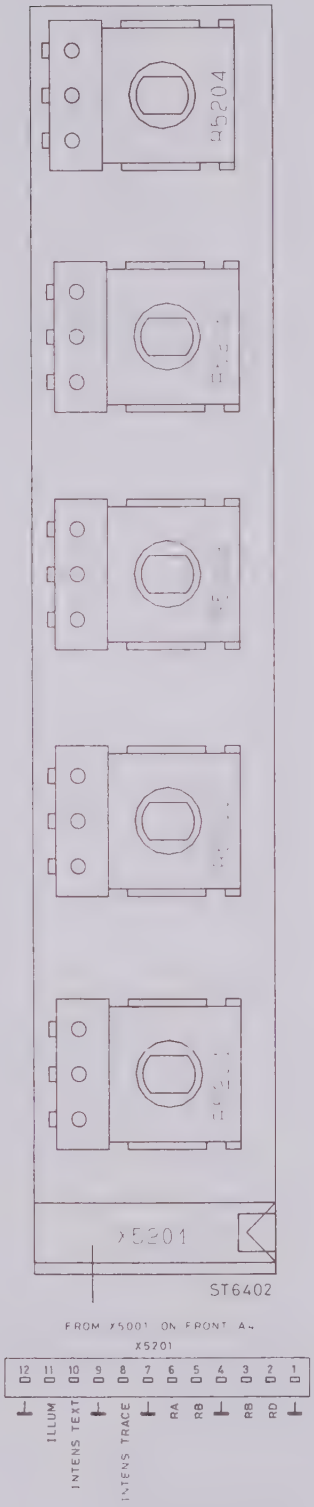
Diodes are used throughout the key and rotary matrix to guarantee that false information is not read by the microprocessor in case more than one control is operated at a time.

Note: The connectors X5001 on unit A4 and X5201 on unit A5 have opposite numeration.

5.5.2 Unit Lay-outs

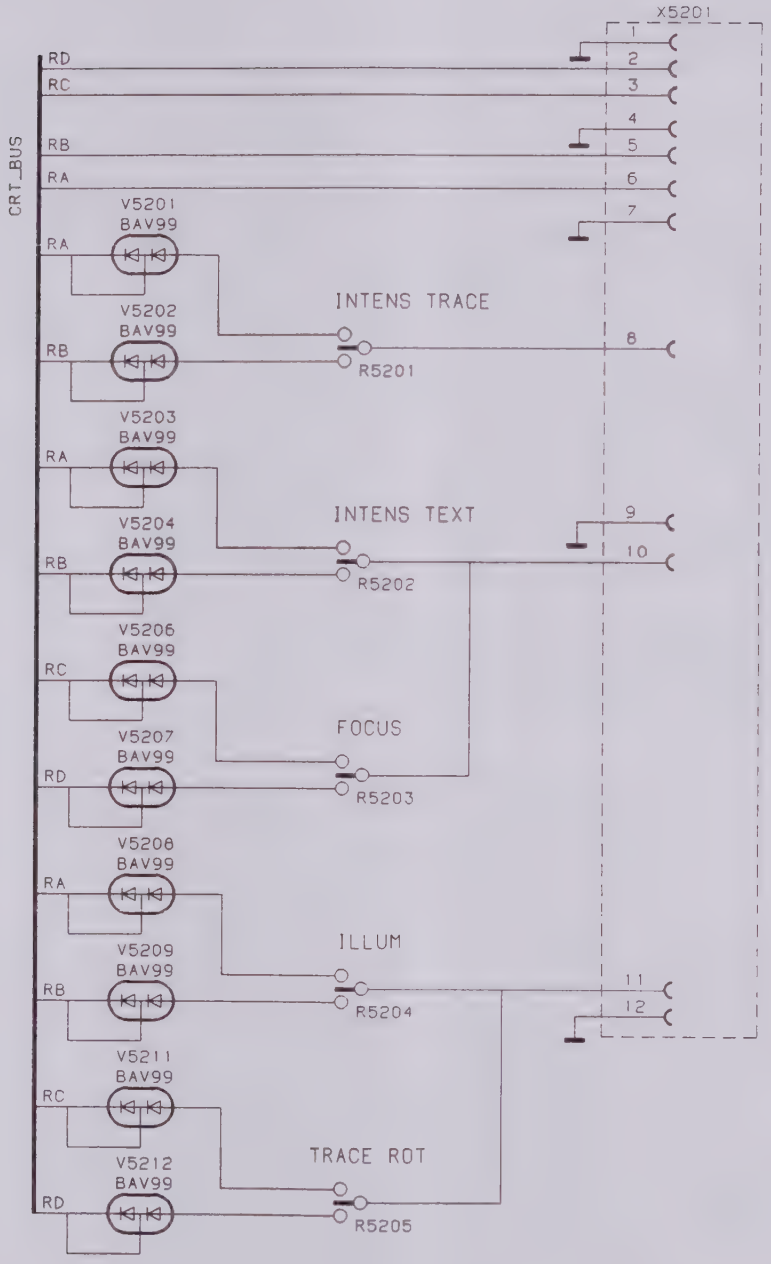


Lay-out 1; Smal component side of CRT controls unit A5



Lay-out 2; Large component side of CRT controls unit A5

5.5.3 Circiuit diagram



A5 - Diagram1; CRT controls unit ST6385

5.5.4 Parts list

Item	Description		Ordering code
SEMICONDUCTORS			
V 5201	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5202	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5203	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5204	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5206	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5207	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5208	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5209	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5211	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 5212	DIODE,CHIP	BAV99 PEL	5322 130 34337
ROTARY SWITCHES			
R 5201	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5202	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5203	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5204	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
R 5205	SWITCH,ROTARY	15-SL.PHILICODER	5322 105 90036
CONECTORS			
X 5201	CONNECTOR	P 1.25MM STR	4822 267 50668

5.6 POWER SUPPLY A6

5.6.1 Description A6

Diagram 1

Diagram 1 comprises the following circuit parts:
- input circuit
- converter circuit
- line trigger circuit

Input circuit

Input to the circuit is the mains voltage. The following voltages are allowed:
- AC voltage between 90 and 250 V
- Theoretically a DC voltage between 100 and 380 V can be applied.

The mains input is primarily protected by a slow acting 1.6 A fuse (1.6 AT), which is located on the rear of the instrument.
Inrush current limiting is provided by NTC resistor R1001.
By means of the capacitors C1002, C1003, C1004 and C1006, an input signal for the line trigger generator is made. The capacitors form a voltage divider. This functions only if the mains voltage is AC.

C1001, 1002, 1006, 1007 and L1001 are for interference suppression.
The mains voltage is rectified by V1001 through 1004 and smoothed by C1008 and C1009.
The output voltage from the rectifier at C1009 can between 100 and 380 V.

WARNING: For measurements in the primary circuit, the use of an isolating transformer is strongly recommended. If no isolating transformer is used, all measurements in the primary circuit must be carried out with floating measuring instruments.

Converter circuit

The power supply is a multiple output flyback converter of the SOPS (Self Oscillating Power Supply) principle. Basically, the converter consists of a switch with control circuitry (transistor V1019) and a transformer (T1001).
The first switching-on of V1019 is initiated by a small current via R1007/R1008. When V1019 is ON, the control voltage of T1001 pin 18 to C1011 is positive and this keeps V1016 and V1019 ON. During the ON or FORWARD cycle, the current through the primary winding of T1001 increases linearly, and energy (0.5 LI^2) is stored into this transformer. At about 2.5 A, this value is determined by the control circuit, thyristor V1014 is switched ON and due to this, V1019 is switched OFF. This is the beginning of the OFF or FLYBACK cycle. Now, the transformer voltages are reversed and the stored energy is transformed to the secondary windings. As long as the transformer is not fully demagnetized, the voltage from pin 18 to C1011 is negative and this will keep V1007, V1016 and V1019 switched OFF. As soon as the transformer demagnetizing has ended, this voltage becomes zero and so, a positive going voltage appears at C1011. Due to this, V1007, V1016 and V1019 are switched ON and the FORWARD cycle starts again.

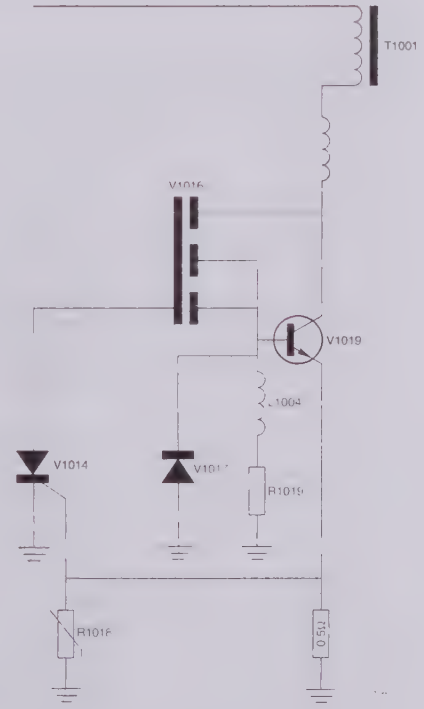


Figure 5.5 Converter circuit

To reduce the switching losses in V1019, a dV/dt limiter, often called "snubber", is used. C1021 decreases the dV/dt of the collector voltage of V1019 during switching off, as the current to the transistor can pass during a certain time through C1021. This slowing down of the collector voltage will reduce the switching losses during switching off. During the ON cycle, the energy in C1021 is transferred to L1006 and the capacitor is discharged. During the OFF cycle, the energy in L1006 is transferred to C1018 and during the next ON cycle, the energy in C1018 is delivered to the transformer. In that way, no energy is wasted. As a consequence of this system, the voltage at the transformer is slightly increased during the first part of the ON cycle, but this has no disadvantages.

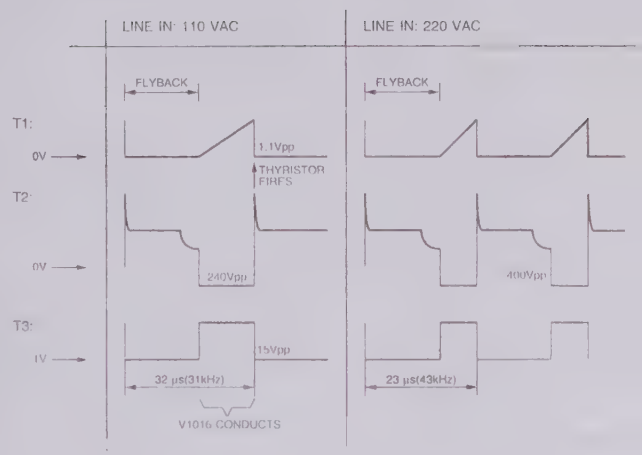


Figure 5.6 Timing diagram converter circuit

Voltage regulation takes place by varying the control voltage from R1046 to the gate of V1014. A more positive voltage will cause a smaller peak current through the transformer and this results in smaller output voltages. The converter frequency can be 20 to 50 kHz. This depends on the mains voltage and the load of the power supply. The lower the mains voltage, the lower the frequency. A lower load means a higher frequency. R1018 compensates for gate-cathode voltage variations of V1014 due to the temperature.

Line trigger circuit

For triggering purposes, a sinusoidal signal at the mains frequency is available. Of course there will be no LINE signal if the mains voltage is DC.
A small signal is picked up with capacitors C1002, C1003, C1004 and C1006 and amplified in N1046. This results in output signal at pin 1. This circuit provides a sine-wave with low distortion and with an amplitude of 3 to 8 V, depending on the mains voltage.

Diagram 2

Diagram 2 comprises the following circuit parts:

- trace rotation control
- fan control
- illumination control
- EHT converter

Trace rotation control

To supply the trace rotation coil, of which the resistance is about 200 Ω, a voltage of -10 V to +10 V is created in amplifier V1146-1147. Control takes place via a part of N1101 by means of the signal DAC3 which can be 1 to 10 V, together with the signal DAC0 with a level between 1 and 3V. The signals DAC3 and DAC0 originate from the microprocessor unit A3.

Fan control

The speed the cooling fan depends on the temperature in the oscilloscope. This temperature is measured at the microprocessor unit A3 by a NTC resistor. The microprocessor generates the signal DAC1 with a level of about 1.7 to 4 V. The fan is supplied by amplifier V1148 which is controlled by this signal. The output from the amplifier is a DC voltage of -10 to +10 V.

Illumination control

The illumination of the graticule must be variable. For this reason the illumination voltage can be varied between about 2 and 28 V. Control of the illumination amplifier V1148 takes place by means of the signal DAC2, level about 1.7 to 4 V. The output voltage from the amplifier is -16 to +10 V.

EHT converter

The EHT converter supplies three voltages.

- An AC voltage of 6,3 V (F1, F2), to supply the filament of the CRT.
- The cathode voltage to the CRT, a DC voltage of -2200 V.
- The post acceleration voltage to the CRT, a DC voltage of +14 kV.

These voltages are made in a separate converter, equipped with a separate transformer. The EHT converter is a resonant flyback converter, the output voltages of the transformer are sinusoidal.

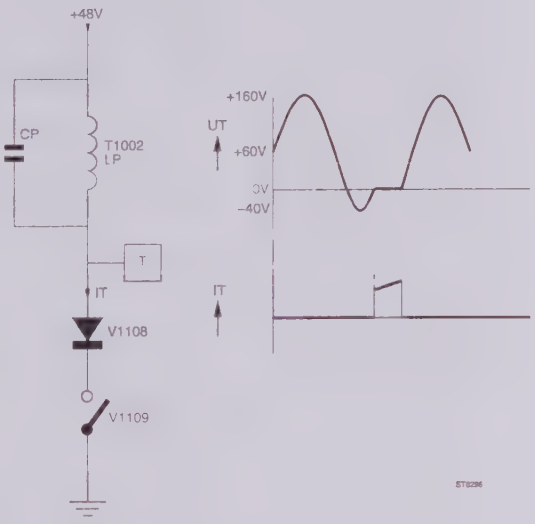


Figure 5.7 High tension generator

Basically, the converter consists of a resonant LC circuit formed by the transformer with its parasitic capacitances. This resonance circuit defines the converter frequency which is about 80 kHz. Energy is supplied to this LC circuit by injecting current to it from the supply voltage, the +58 V, by switching ON V1109. Most of the time, V1109 is OFF. The primary peak to peak amplitude is about 200 V, the negative peak about -40 V. During the positive half of the sine-wave, capacitor C1111 is discharged very little via R1114.

When the sine-wave reaches its most negative value, a small current will pass through C1111 and V1106 and this acts as base current for V1102. Due to this, the thyristor configuration V1102-1109 will be switched ON and energy is supplied to the resonant circuit. The ON time of V1109 can be controlled by the operational amplifier N1101 pin 7.

To protect against too high voltages, e.g. caused by a defective N1101, the circuit is provided with an over-voltage protection. This circuit consists of V1103 and V1104. The maximum output voltage is defined by this circuit as it will overrule the control circuit at too high voltage.

The AC voltage at T1002 pins 4 and 5 is used to supply the CRT filament voltage of 6.3 V.
The voltage at pins 11 and 3 is rectified and this -2200 V is used as CRT cathode voltage. The voltage at pins 11 and 2 is rectified and multiplied in a cascade circuit. The output, +14 kV, is used as post acceleration voltage to the CRT.

Diagram 3

Diagram 3 comprises the following circuit parts:

- secondary output circuitry
- over- and under-voltage protection
- power fail circuit
- temperature protection
- 10 V reference circuit
- +5V postregulator circuit

Secondary output circuitry
The secondary output circuits consist of rectifier diodes and buffer capacitors, followed by chokes and capacitors for ripple suppression. The output circuits are protected against overload by the under voltage protection.

Over and under-voltage protection
To protect the oscilloscope circuitry against over-voltage and the supply circuits against overload, the power supply is provided with a protection circuit. As, due to the multiple output principle, the output voltages are interdependent, it is sufficient to check only one voltage. In case of overload, the output voltages will decrease and this will be detected by the under-voltage detection, V1241, which monitors the -12 V. This will cause the collector of V1241 to be LOW. In case of over-voltage, the over-voltage detection detects a too high +12 V or +5 V and this will cause pin 13 of N1236 to be LOW. Due to this LOW signal, the intervention circuit V1241-1242-1243 will cause a current, the TPDOWN signal, to V1213. This will switch ON this thyristor and this causes switching off the converter by decreasing all output voltages to a very low, safe value.

Powerfail circuit
In normal cases, about 250 ms after switching on, the signal POWER HT will become HIGH and stay HIGH. In case of an over- or under-voltage failure, the signal will become LOW due to V1242. In case of a too low mains voltage, i.e. less than 80 V (AC) or 100 V (DC), the signal will become LOW due to N1236 pin 2. The signal POWER HT is a logic signal, it will not switch off the main convertor circuit, but it will shut down the EHT-convertor. POWER HT signals to the microprocessor unit A3 that power is going down. This gives the processor the opportunity to save important data.

Temperature protection.
To protect the circuits against too high temperatures, the oscilloscope is provided with an overheat shutdown circuit. The temperature of the power supply printed circuit board is monitored by NTC resistor R1231, which is located on the PCB. At temperatures higher than about +80 °C, pin 8 of N1236 will become HIGH and this will cause pin 14 to be LOW. Due to this, the TPDOWN signal becomes active and the converter is switched off by triggering V1213. This temperature protection is only meant for the power supply.

+10 V reference circuit
For application in the power supply and at other places in the oscilloscope, a stable +10 V reference voltage is needed. This voltage is made by N1226/V1226 in the power supply. The voltage is not adjustable. The accuracy is ±5 mV. Temperature coefficient is ±0,001°K. The load of the +10 V is about 10 mA.

+5 V postregulator circuit
The +5 V supply voltage originates from the T1001/16,15 transformer winding that supplies current during the forward stroke of the power supply: thus during the time that V1019 conducts. The current runs via transductor coil L1271, diode V1271 and the coils L1272/L1273. During the flyback stroke (power transistor V1019 off) the current runs via diode V1271 (anode connected to earth) and L1272/L1273.

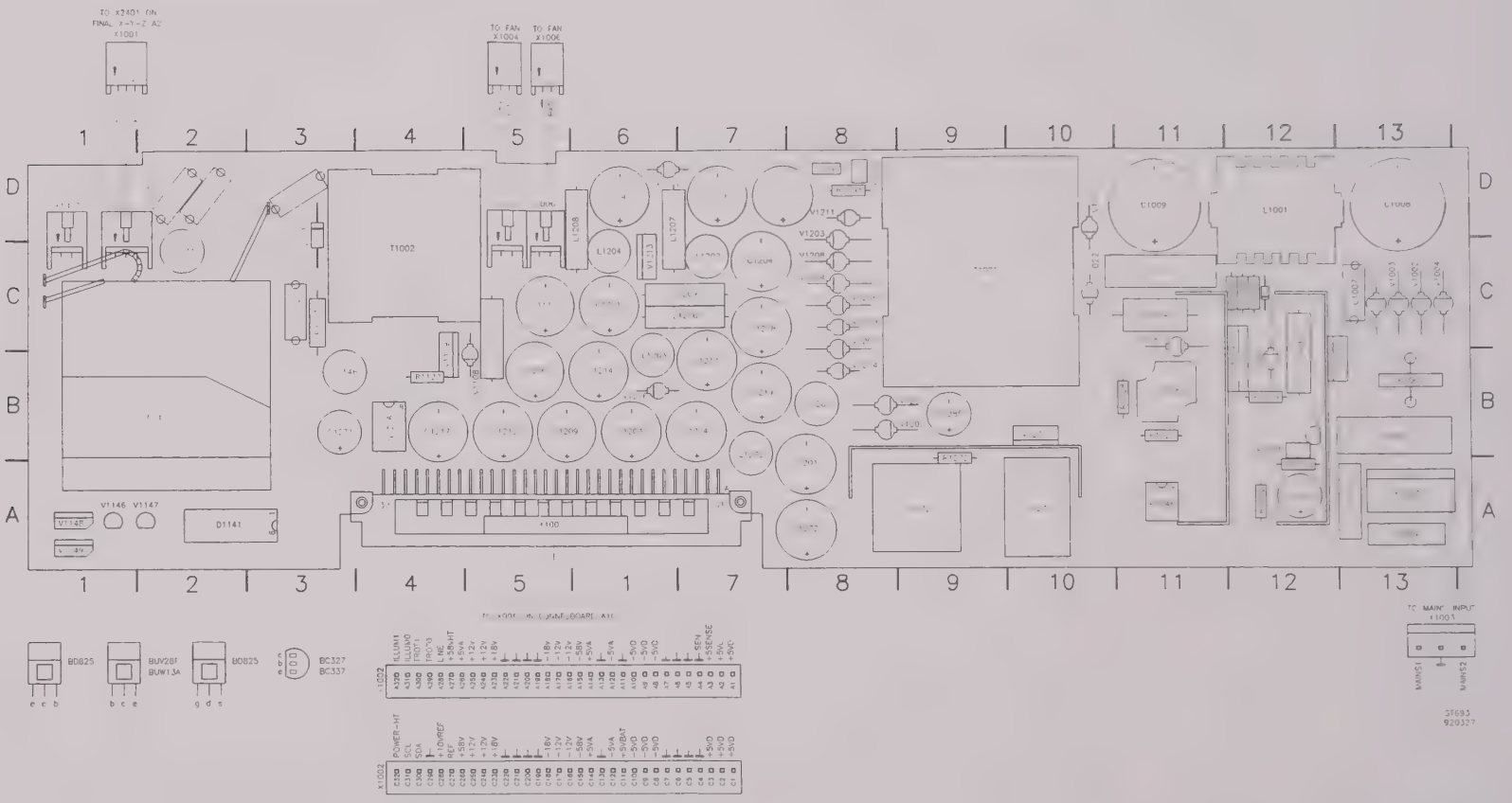
Output voltage regulation occurs via the operational amplifier N1251/1,2,2 and the paralelled transistors V1251/V1252. N1252 compares the actual +5 V output voltage with the +10 VREF reference voltage. Output N1251/1 becomes lower in case that the +5 V output voltage tends to become too high. The result is an increase of the collector current of V1252/V1252. This gives a current in L1271 opposite to the +5 V supply current. This delays the moment that L1271 comes into saturation. Thus L1271 behaves like a coil during a longer period of time with the result that a certain loss of voltage across it stays. As a result the output voltage becomes lower. If saturated the voltage loss across L1271 is 0 volt.

5.6.2 Signal name list A6

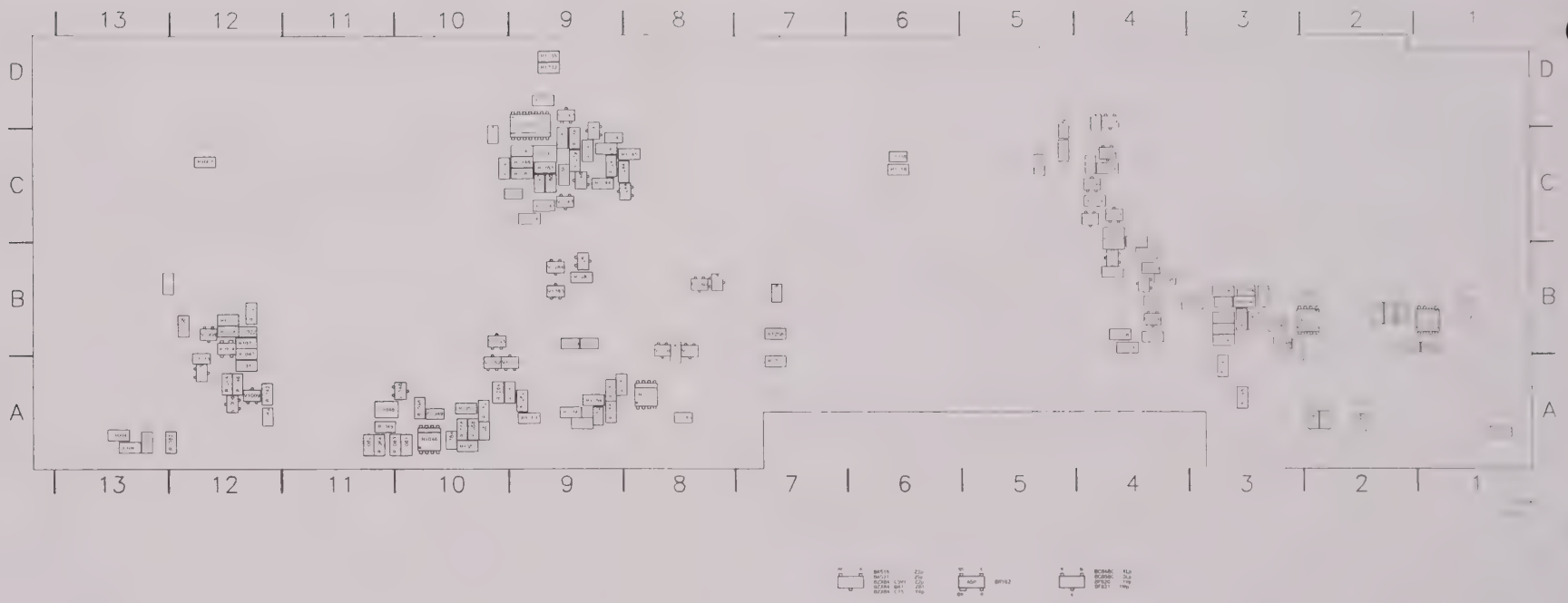
Note: In the signal name list you find the itemnumber of the component that is source or destination. Behind this itemnumber (separated by ":") you find the number of the diagram where the source/destination can be found.

NAME	MEANING	SOURCE	DESTINATION
+5 SENS	+5 V OUTPUT SENSE SIGNAL	X1002:02	R1253:03
FAN0	FAN SUPPLY 0	S-12V:02	X1004:02
FAN1	FAN SUPPLY 1	L1146:02	X1004:02
GNSENS	GROUND FOR +5 V SENSE SIGNAL	X1002:02	R1257:03
ILLUM0	GRATICULE ILLUMINATION 0	S-18V:02	X1002:02
ILLUM1	GRATICULE ILLUMINATION 1	V1149:02	X1002:02
LINE	LINE/MAINS TRIGGER SIGNAL	N1046:01	X1002:01
POWER-HT	POWER UP INDICATION SIGNAL	N1236:03	X1002:03 V1111:02
SCL	SERIAL CLOCK	X1002:02	N1141:02
SDA	SERIAL DATA	X1002:02	N1141:02
TROT0	TRACE ROTATION 0	EARTH:02	X1002:02
TROT1	TRACE ROTATION 1	V1146:02	X1002:02

5.6.3 Unit lay-outs

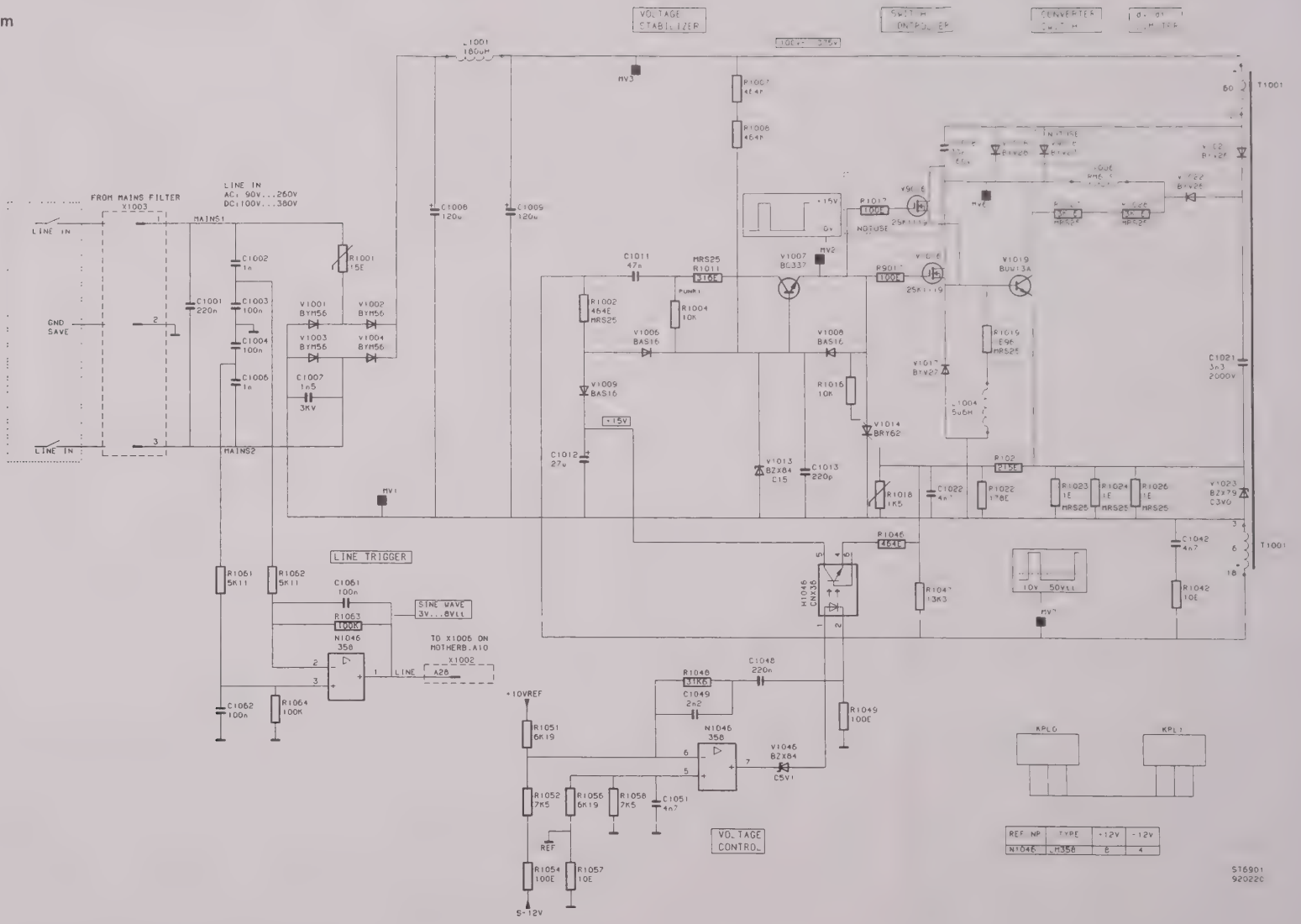


Lay-out 1 - Large component side of Power Supply unit A6

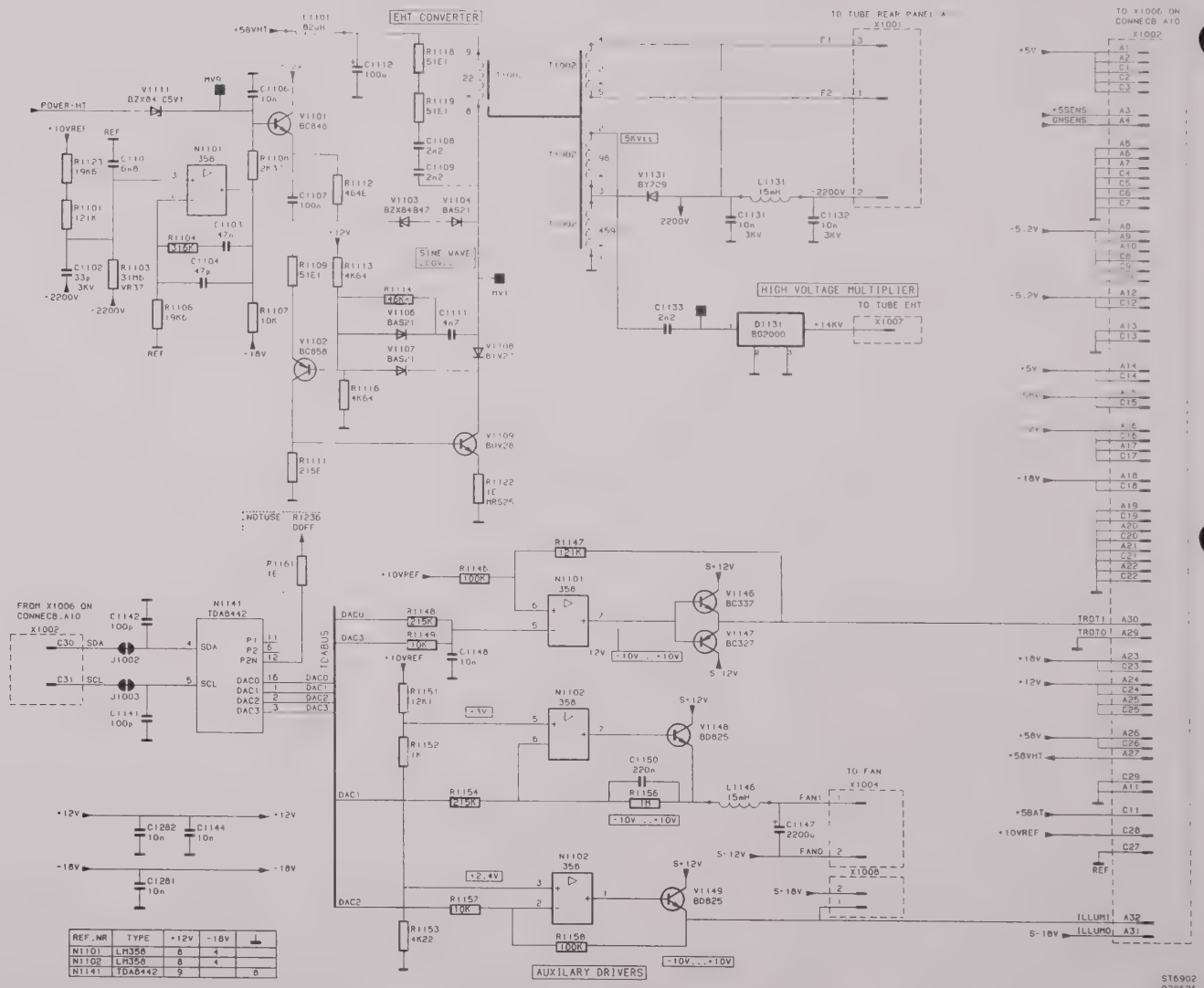


Lay-out 2 - Small component side of Power Supply unit A6

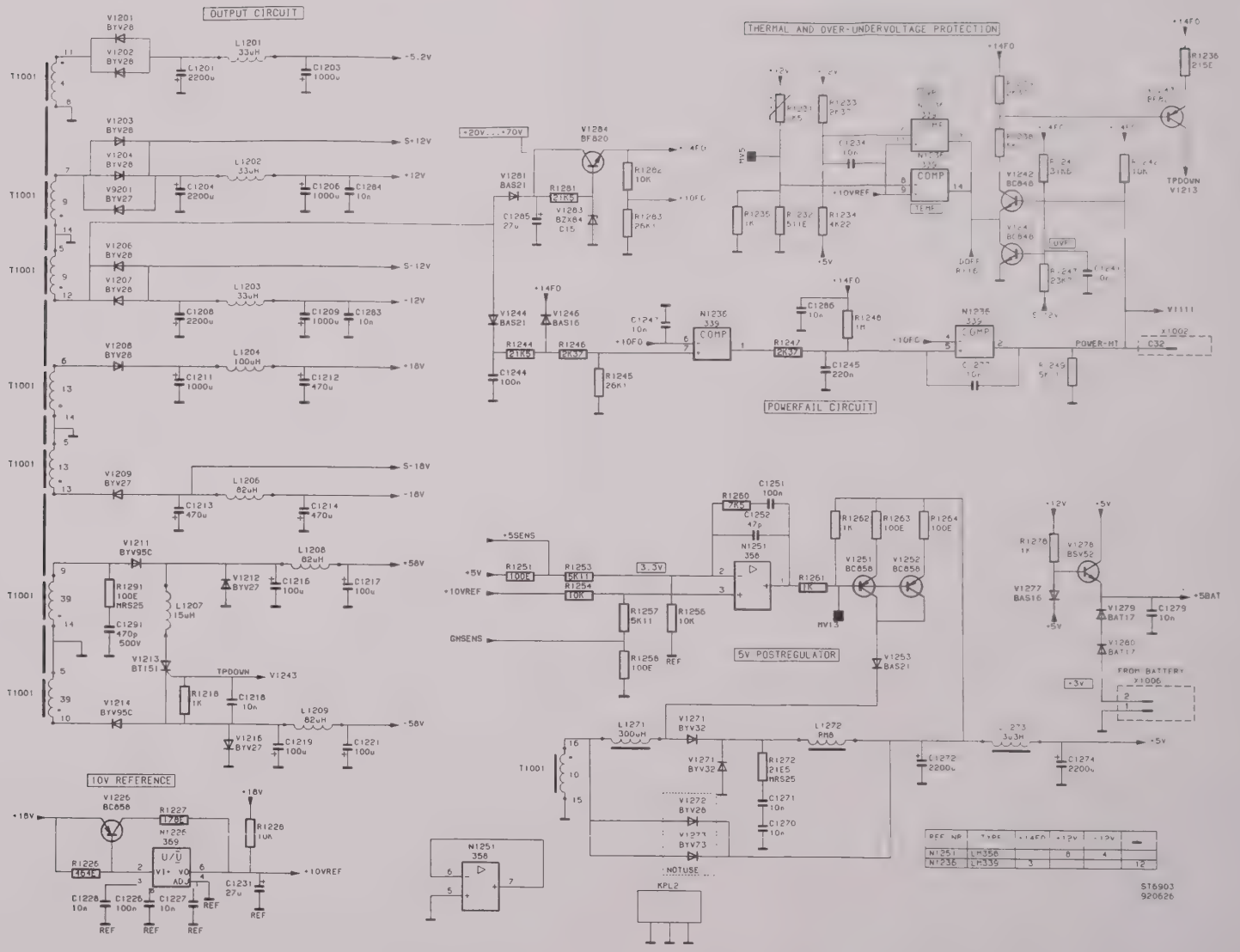
5.6.4 Circuit diagram



A6 - Diagram 1; Converter circuit



A6 - Diagram 2; EHT converter and auxiliary circuits



A6 - Diagram 3; Output circuit and protection circuits

5.6.5 Parts list

CAPACITORS

Item	Description		Ordering code
C 1001	CAP.FOIL	250V 20% 220nF	5322 121 44372
C 1002	CAP.FOIL	-20+20% 1nF	5322 121 43656
C 1003	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1004	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1006	CAP.FOIL	-20+20% 1nF	5322 121 43656
C 1007	CAP.CERAMIC	3KV -20+50% 1.5nF	5322 122 50092
C 1008	CAP.ELECTROLYT.	400V 20% 120µF	5322 124 42231
C 1009	CAP.ELECTROLYT.	400V 20% 120µF	5322 124 42231
C 1011	CAP.CHIP	63V 10% 47nF	4822 122 32542
C 1012	CAP.ELECTROLYT.	100V 20% 27µF	5322 124 42193
C 1013	CAP.CHIP	63V 5% 220pF	4822 122 33575
C 1018	CAP.FOIL	160V 1% 33nF	5322 121 50997
C 1021	CAP.FOIL	2KV 5% 3.3nF	5322 121 70117
C 1022	CAP.CHIP	63V 10% 4.7nF	5322 126 10223
C 1042	CAP.CHIP	63V 10% 4.7nF	5322 126 10223
C 1048	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 1049	CAP.CHIP	63V 10% 2.2nF	4822 122 33127
C 1051	CAP.CHIP	63V 10% 4.7nF	5322 126 10223
C 1061	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1062	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1101	CAP.CHIP	63V 10% 6.8nF	5322 122 31866
C 1102	CAP.CERAMIC	4KV -10+10% 33pF	5322 122 33081
C 1103	CAP.CHIP	63V 10% 47nF	4822 122 32542
C 1104	CAP.CERAMIC	63V 5% 47pF	5322 122 32452
C 1106	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1107	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1108	CAP.CHIP	63V 10% 2.2nF	4822 122 33127
C 1109	CAP.CHIP	63V 10% 2.2nF	4822 122 33127
C 1111	CAP.CHIP	63V 10% 4.7nF	5322 126 10223
C 1112	CAP.ELECTROLYT.	100V 20% 100µF	5322 124 42227
C 1114	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 1131	CAP.CERAMIC	3KV -20+50% 10nF	5322 122 50091
C 1132	CAP.CERAMIC	3KV -20+50% 10nF	5322 122 50091
C 1133	CAP.	-10+10% 2.2nF	5322 122 33851
C 1144	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1147	CAP.ELECTROLYT.	25V 20% 2200µF	5322 124 42229
C 1148	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1150	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 1201	CAP.ELECTROLYT.	25V 20% 2200µF	5322 124 42229
C 1203	CAP.	25V -20+20% 1000µF	5322 124 23276
C 1204	CAP.ELECTROLYT.	25V 20% 2200µF	5322 124 42229
C 1206	CAP.	25V -20+20% 1000µF	5322 124 23276
C 1208	CAP.ELECTROLYT.	25V 20% 2200µF	5322 124 42229
C 1209	CAP.	25V -20+20% 1000µF	5322 124 23276
C 1211	CAP.	25V -20+20% 1000µF	5322 124 23276

Item	Description		Ordering code
C 1212	CAP.FOIL	25V 20% 470µF	5322 121 43885
C 1213	CAP.FOIL	25V 20% 470µF	5322 121 43885
C 1214	CAP.FOIL	25V 20% 470µF	5322 121 43885
C 1216	CAP.ELECTROLYT.	100V 20% 100µF	5322 124 42227
C 1217	CAP.ELECTROLYT.	100V 20% 100µF	5322 124 42227
C 1218	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1219	CAP.ELECTROLYT.	100V 20% 100µF	5322 124 42227
C 1221	CAP.ELECTROLYT.	100V 20% 100µF	5322 124 42227
C 1226	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1227	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1228	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1231	CAP.ELECTROLYT.	100V 20% 27µF	5322 124 42193
C 1234	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1241	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1244	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1245	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 1247	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1251	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 1252	CAP.CERAMIC	63V 5% 47pF	5322 122 32452
C 1270	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1271	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1272	CAP.ELECTROLYT.	25V 20% 2200µF	5322 124 42229
C 1274	CAP.ELECTROLYT.	25V 20% 2200µF	5322 124 42229
C 1277	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1279	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1281	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1282	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1283	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1284	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1285	CAP.ELECTROLYT.	100V 20% 27µF	5322 124 42193
C 1286	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 1291	CAP.CERAMIC	500V 10% 470pF	4822 122 31177

MISCELLANEOUS

H 1046	TRANSIST,PHOTO	CNX36U PEL	5322 130 91112
T 1001	TRANSFORMER	MAIN TRAFO	5322 142 50172
T 1002	TRANSFORMER	EHT TRAFO	5322 148 60255

COILS

L 1001	COIL	ECH30 180UH TDK	5322 157 63378
L 1004	COIL	5.6UH	4822 157 52259
L 1101	COIL	82UH	4822 158 10563
L 1131	COIL	0.015H TDK	5322 157 63383
L 1146	COIL	0.015H TDK	5322 157 63383
L 1201	COIL	33UH TDK	4822 157 62886
L 1202	COIL	33UH TDK	4822 157 62886
L 1203	COIL	33UH TDK	4822 157 62886
L 1204	COIL	100UH TDK	5322 157 52363
L 1206	COIL	82UH	4822 158 10563

Item	Description		Ordering code
L 1207	COIL	15UH	5322 157 52539
L 1208	COIL	82UH	4822 158 10563
L 1209	COIL	82UH	4822 158 10563
L 1271	COIL	TRANSDUCTORCOIL	5322 157 63931
L 1273	COIL	3.3UH TDK	5322 157 53017

INTEGRATED CIRCUITS

D 1131	UNIT,ELECTRICAL	BG2000-641-512	5322 214 90731
N 1046	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 1101	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 1102	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 1141	INTEGR.CIRCUIT	TDA8442/N3 PEL	4822 209 71703
N 1226	INTEGR.CIRCUIT	LM369DN NSC	5322 209 30266
N 1236	INTEGR.CIRCUIT	LM339D SIG	5322 209 70684
N 1251	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175

RESISTORS

R 1001	RES.N.T.C.	2.2A 15E	5322 116 34035
R 1002	RES.METAL FILM	MRS25 1% 464E	4822 050 24641
R 1004	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1007	RES.CHIP	RC-02H 1% 464K	4822 051 54644
R 1008	RES.CHIP	RC-02H 1% 464K	4822 051 54644
R 1011	RES.METAL FILM	MRS25 1% 316E	4822 050 23161
R 1016	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1018	RES.N.T.C.	0.5W 10% 1K5	4822 116 30248
R 1019	RES.METAL FILM	MRS25 1% 1E96	4822 050 21968
R 1021	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 1022	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 1023	RES.METAL FILM	MRS25 1% 1E	4822 050 21008
R 1024	RES.METAL FILM	MRS25 1% 1E	4822 050 21008
R 1026	RES.METAL FILM	MRS25 1% 1E	4822 050 21008
R 1027	RES.METAL FILM	MRS25 1% 3K16	4822 050 23162
R 1028	RES.METAL FILM	MRS25 1% 3K16	4822 050 23162
R 1042	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1046	RES.CHIP	RC-02H 1% 464E	4822 051 54641
R 1047	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 1048	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 1049	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1051	RES.CHIP	RC-02H 1% 6K19	4822 051 56192
R 1052	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 1054	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1056	RES.CHIP	RC-02H 1% 6K19	4822 051 56192
R 1057	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 1058	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 1061	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1062	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1063	RES.CHIP	RC-02H 1% 100K	4822 051 51004

Item	Description		Ordering code
R 1064	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1101	RES.CHIP	RC-02H 1% 121K	4822 051 51214
R 1103	RES.HI-TENSION	VR37 1% 31M6	5322 116 64103
R 1104	RES.CHIP	RC-02H 1% 316K	4822 051 53164
R 1106	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 1107	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1108	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1109	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1111	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 1112	RES.CHIP	RC-02H 1% 464E	4822 051 54641
R 1113	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 1114	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 1116	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 1118	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1119	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 1122	RES.METAL FILM	MRS25 1% 1E	4822 050 21008
R 1123	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 1146	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1147	RES.CHIP	RC-02H 1% 121K	4822 051 51214
R 1148	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1149	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1151	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 1152	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1153	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 1154	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 1156	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 1157	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1158	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 1218	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1226	RES.CHIP	RC-02H 1% 464E	4822 051 54641
R 1227	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 1228	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1231	RES.N.T.C.	0.5W 10% 1K5	4822 116 30248
R 1232	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 1233	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1234	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 1235	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1236	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 1238	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1239	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1241	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 1242	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1243	RES.CHIP	RC-02H 1% 23K7	4822 051 52373
R 1244	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1245	RES.CHIP	RC-02H 1% 26K1	4822 051 52613
R 1246	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1247	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 1248	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 1249	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1251	RES.CHIP	RC-02H 1% 100E	4822 051 51001

Item	Description		Ordering code
R 1253	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1254	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1256	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1257	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 1258	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1260	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 1261	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1262	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1263	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1264	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 1272	RES.METAL FILM	MRS25 1% 21E5	4822 050 22159
R 1278	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 1281	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 1282	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 1283	RES.CHIP	RC-02H 1% 26K1	4822 051 52613
R 1291	RES.METAL FILM	MRS25 1% 100E	4822 050 21001
R 9017	RES.CHIP	RC-02H 1% 100E	4822 051 51001

SEMICONDUCTORS

V 1001	DIODE	BYM56E PEL	4822 130 80254
V 1002	DIODE	BYM56E PEL	4822 130 80254
V 1003	DIODE	BYM56E PEL	4822 130 80254
V 1004	DIODE	BYM56E PEL	4822 130 80254
V 1006	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 1007	TRANSISTOR	BC337 PEL	4822 130 40855
V 1008	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 1009	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 1013	DIODE,CHIP	BZX84-C15 PEL	5322 130 33662
V 1014	TRANSISTOR,CHIP	BRY62 PEL	5322 130 62661
V 1016	MOSFET	2SK1119	
V 1017	DIODE	BYV27-150 PEL	4822 130 31628
V 1018	DIODE	BYV28-150 PEL	5322 130 32043
V 1021	DIODE	BYV26C PEL	4822 130 32343
V 1022	DIODE	BYV26C PEL	4822 130 32343
V 1023	DIODE,REFERENCE	BZX79-C3V0 PEL	4822 130 31881
V 1046	DIODE,CHIP	BZX84-C5V1 PEL	5322 130 32835
V 1101	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 1102	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1103	DIODE,CHIP	BZX84-B47 PEL	4822 130 82521
V 1104	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 1106	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 1107	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 1108	DIODE	BYV27-150 PEL	4822 130 31628
V 1109	TRANSISTOR	BUV28F PEL	5322 130 62803
V 1111	DIODE,CHIP	BZX84-C5V1 PEL	5322 130 32835
V 1131	DIODE	BY709 PEL	5322 130 82711
V 1146	TRANSISTOR	BC337 PEL	4822 130 40855
V 1147	TRANSISTOR	BC327 PEL	4822 130 40854
V 1148	TRANSISTOR	BD825 PEL	4822 130 41746

Item	Description		Ordering code
V 1149	TRANSISTOR	BD825 PEL	4822 130 41746
V 1201	DIODE	BYV28-150 PEL	5322 130 32043
V 1202	DIODE	BYV28-150 PEL	5322 130 32043
V 1203	DIODE	BYV28-150 PEL	5322 130 32043
V 1204	DIODE	BYV28-150 PEL	5322 130 32043
V 1206	DIODE	BYV28-150 PEL	5322 130 32043
V 1207	DIODE	BYV28-150 PEL	5322 130 32043
V 1208	DIODE	BYV28-150 PEL	5322 130 32043
V 1209	DIODE	BYV27-150 PEL	4822 130 31628
V 1211	DIODE	BYV95C PEL	4822 130 41487
V 1212	DIODE	BYV27-150 PEL	4822 130 31628
V 1214	DIODE	BYV95C PEL	4822 130 41487
V 1216	DIODE	BYV27-150 PEL	4822 130 31628
V 1226	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1241	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 1242	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 1243	TRANSISTOR,CHIP	BF821 PEL	4822 130 61923
V 1244	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 1246	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 1251	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1252	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 1253	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 1271	DIODE	BYV32-150 PEL	5322 130 31637
V 1277	DIODE,CHIP	BAS16 PEL	5322 130 31928
V 1278	TRANSISTOR,CHIP	BSVS2 PEL	5322 130 44336
V 1279	DIODE,CHIP	BAT17 PEL	5322 130 31544
V 1280	DIODE,CHIP	BAT17 PEL	5322 130 31544
V 1281	DIODE,CHIP	BAS21 PEL	4822 130 33702
V 1283	DIODE,CHIP	BZX84-C15 PEL	5322 130 33662
V 1284	TRANSISTOR,CHIP	BF820 PEL	5322 130 62802

CONNECTORS

X 1001	CONNECTOR	3-P SNG RT.ANG	5322 265 30433
X 1002	CONNECTOR	64-P PIN 2.54MM	5322 290 61087
X 1003	CONNECTOR	5-P SNG STRGHT	5322 265 30436
X 1004	CONNECTOR	2-P SNG RT.ANG	5322 265 20525
X 1006	CONNECTOR	2-P SNG RT.ANG	5322 265 20525
X 1008	CONNECTOR	2-P SNG RT.ANG	5322 265 20525

5.7 RESERVED FOR FUTURE EXTENSIONS

5.8 DIGITIZER A8

5.8.1 Descriptions

5.8.1.1 Diagram 1

5.8.1.2 Diagram 2

Vertical channel inputs

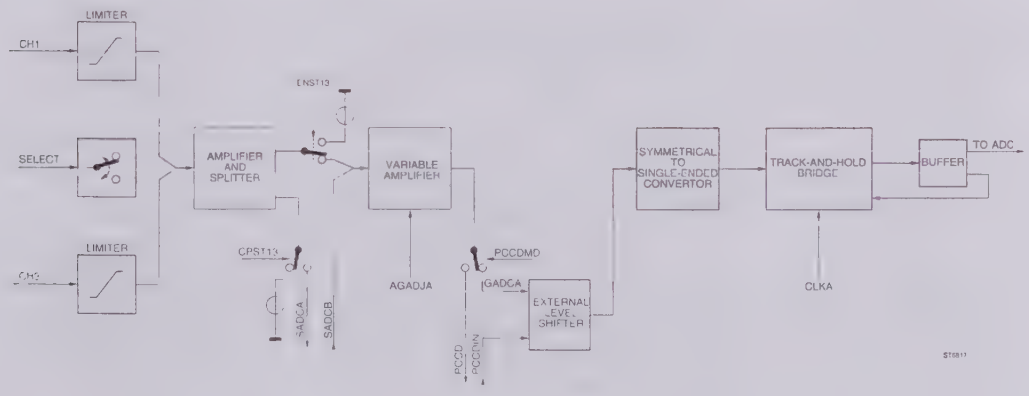
Four input channel signals are derived from the analog oscilloscope section unit A1.
Channel 1 : X1301/X1302
Channel 2 : X2301/X2302
Channel 3 : X3301/X3302
Channel 4 : X4301/X4302
The d.c. current is 4 mA and the sensitivity is 100 µa/division (200 µa/division differential).

Buffer/splitters

Each input signal path is split into equal signal paths by the signal splitters consisting of the transistor packages N8023, N8022, N8024 and N8021. One is the vertical input signal path and the other is the input trigger signal path.
The input channel signals are applied to the four buffer/splitter stages N8023, N8022, N8024 and N8021 as four times two symmetrical signals. They are applied by connectors and cables with a characteristic impedance of 50 Ohm. The buffer/splitter stages are configurated as level shifters which are formed for channel 1 for example with N8023/9-10-11 and N8023/6-7-8.
For the HF adjustment of each channel, a fixed RC network (C8581/R8581 for channel 1) as well as an adjustable network (R8210/diode-V8188 for channel 1) are present between the two emitters. The capacity of the diodes can be adjusted by signals HFADJ1, HFADJ2, HFADJ3 and HFADJ4 in order to realize correct HF adjustment.

Main Analog Signal Processor Unit (MASPU)

The resulting signal currents in the vertical input signal paths are applied via input stages to the Main Analog Signal Processor Units. These are MASPU-A (N8026) for input channels 1 and 3 and MASPU-B (N8027) for input channels 2 and 4.



Each MASPU circuit contains the following circuits: limiter, channel selector, amplifier and splitter, variable amplifier, external level shifter, symmetrical to single-ended converter, Track & Hold bridge and buffer. A MASPU is able to handle two symmetrical analog input current (100 µA/division) signals.

MASPU-A description

The channel 1 and 3 signals are amplified and limited to signal levels of +/- 600 µA/division, which cover a dynamic range of +/- 6 vertical divisions on the oscilloscope display.

For the correct functioning of the limiter circuits, dc feedback loops are required, using external transistors V8021 and V8019.
The output currents of the two limiter circuits are applied to amplifier and splitter stages in a multiplexed way. This is controlled by the differential selection signals (2 mA) CHOP1 and CHOP3. This can be done in chopped way (max. 5 MHz) or in alternated way.
The output current of the amplifier is split into two equal signal paths. Splitting offers the possibility to send a replica of the chosen vertical input signal to the second MASPU (MASPU-B) for the channels 2 and 4.

The signal current from the chosen input channel 1 or 3 can either be passed on to the variable amplifier, or as replica (SADCBPB SADCBNB) of the signal be send to the channel combiner in the second MASPU (MASPU-B) for the channels 2 and 4. Also the output signal current (SADCBNA SADCBPA) of the second MASPU can be sent to the channel combiner in the first MASPU (MASPU-A) for the channels 1 and 3. It is possible to apply the same input signal current to both ADC's at the same time in order to make interleaved sampling on a 200 MHz sample rate possible.

Signals CPST13HT and ENST13HT control the circuit.
- Signal CPST13HT determines whether the replica of the chosen input signal is sent to the second MASPU via the SADCBPB and SADCBNB lines or not. (Required for 200 MS/s sampling.)
- Signal ENST13HT determines whether the chosen input signal is passed on to the variable amplifier stage in the MASPU or the signal from the other MASPU.

In timebase setting 250 ns/div., a selected input channel is connected via both MASPU's to both ADC's, resulting in a double sampling rate of 200 MS/s.

Signal VADCA, which is derived from the offset DAC (DACPOT), represents an additional offset applied to MASPU input pin 9. VADCA is used to adjust the circuit for a level in the centre of the ADC input range if no input signal is applied. This corresponds with the centre of the CRT screen. It is also used to give the MASPU an extra offset in the double sampling mode.

Variable amplifier

After combining the direct or replica signals, a circuit for variable overall gain control is available. Signal AGADJA is the control current input for this variable amplifier. The output of this stage is fed to the amplifier section where the signal current is converted from a symmetrical to a single-ended signal voltage.

Track and Hold bridge

After the amplification and combination stages, the analog signal is applied to a Track and Hold bridge, which is used to sample the signal and keep it at a constant level during the conversion period of the ADC circuit.
The sample-clock signal currents for the Track and Hold circuit are the symmetrical logic signals CLKA and NCLKA with a rise-time of about 2 ns and a fixed frequency of 100 MHz. These signals determine the TRACK-to-HOLD transitions.
In the Track-mode the output voltage of the circuit will follow the input signal variations. In the Hold-mode the internal hold capacitor is isolated from the rest of the circuit and will store the value of the input signal at the moment just before the track-to-hold transition.
Both Track and Hold bridges in MASPU-A and MASPU-B are clocked with the same sample-clock frequency. In double sample mode (200 MS/s sample rate for only one channel), the two Track and Hold bridges receive sample-clock signals which are 180 degrees shifted in phase. This results in twice the sample rate.

The resulting T&H output signal BOUT on point 65 of the MASPU is applied via buffer N8013 to the ADC circuit (on diagram 5) as ANINA. The feedback signal BOOT from N8013 is required by the Track & Hold bridge for correct internal leveling.

Supply current ITREEA

The current ITREEA is a constant current from which the MASPU derives a number of internal supply voltages.

5.8.1.3 Diagram 3

Control, reference and adjustment voltages:

Digital to Analog Converter DACPOT

The sixteen channel 12 bit Digital to Analog Converter POTentiometer DACPOT N8006 derives 14 different analog output signals from the four input bits GLOD04 ... GLOD07 from the GLOBAL data bus. The chip select signal for the converter is signal DACCS-LT and the refresh signal is derived from signal CK12M via D-type flip-flop D8045. The start is initiated via the enable signal DACPENLT which is also derived from the GLOBAL data bus.
Each of these DACPOT output levels is independently adjustable between 1 Volt and 4 Volt in 4096 steps.

Analog output signals are:
OFFSADCA converted in signal VADCA see diagram 1
OFFSADCB converted in signal VADCB see diagram 2

GAINMPUA converted in signal AGADJA see diagram 1
GAINMPUB converted in signal AGADJB see diagram 2

OFFST&HA converted in signals POSAA/POSBA see diagram 1
OFFST&HB converted in signals POSAB/POSBB see diagram 2

OFFSCMP1 see diagram 6
OFFSCMP2 see diagram 6
OFFSCMP3 see diagram 6
OFFSCMP4 see diagram 6

HF1 converted in signal HFADJ1 see diagram 1
HF2 converted in signal HFADJ2 see diagram 2
HF3 converted in signal HFADJ3 see diagram 3
HF4 converted in signal HFADJ4 see diagram 4

Multiplexer D8501

Seven digital control signals arrive via multiplexer D8501 derived from data bit GLOD09 from the GLOBAL data bus and the three address bits GLOA4 ... GLOA6 from the GLOBAL address bus. Signals are mainly generated to control activities in the RAndom Trigger Engine Logic (RATEL) circuit on diagram 8. Outputs which are not selected via the address lines remain in their previous state.

ITREEA/ITREEB circuit

The ITREEA and ITREEB currents for the Main Analog Signal Processing Units (MASPU's) on diagram 1 and 2 are generated via the opamp circuit N8071 and transistors V8012 and V8014.

Channel selector

The chopper signals CHOP1/CHOP3 and CHOP2/CHOP4 for the Main Analog Signal Processing Units (MASPU's) on diagram 1 and 2 are derived from the SLS12 switching signal from the Data Acquisition and tRigger Logic (DARLIC) circuit on diagram 9.

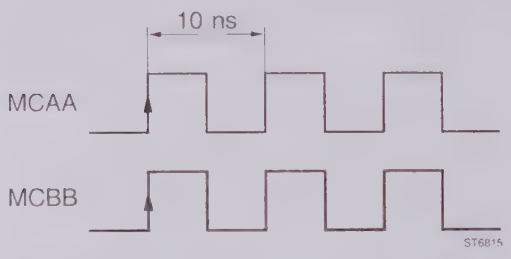
5.8.1.4 Diagram 4

Clock oscillator

The 200 MHz crystal G8025 forms, together with WHISTLER circuit D8005, a 200 MHz clock generator with ECL level output clocksignals MCAA/MCNAA MCBB MCNBB of 100 MHz each for the Analog to Digital Converters on diagram 5, and MCAAR/MCNAAR for the RAndom Trigger Engine Logic (RATEL) circuit on diagram 8.

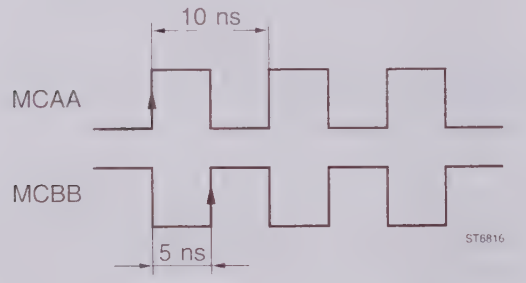
Normal mode:

Normally the oscillator output signals MCAA and MCBB are in phase.



Double sampling mode:

The oscillator is controlled by the signal CLKBINV which is generated via the SBUS (serial bus) shown in diagram 14. This signal in double sampling mode is used to invert the oscillator output signals MCBB/MCNBB. The time between the leading edges of the two signals is now 5 ns and sampling is done at 200 MS/s.



The output signals from the oscillator are applied to the circuits N8067 and N8068, which produce via transistors V8139/V8138 and V8140/V8141 the required clock currents for the Track and Hold bridges. Signals CLKA/NCLKA and CLKB/NCLKB with a frequency of 100 MHz are used on diagrams 1 and 2 as sample-clock signals for the Track and Hold bridges in the Main Analog Signal Processing units.

Clock switches

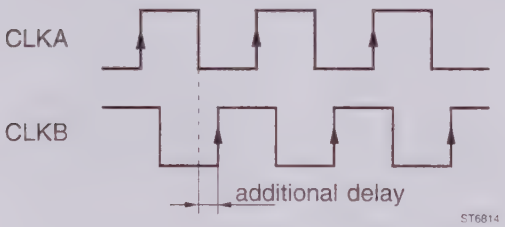
The clock switches N8067 and N8068 are controlled by signals DSAMPAHT/ DSAMPBHT and TRCKMDHT which are generated via the SBUS (serial bus) shown in diagram 14.

Only clock switch N8067 is now described:
One of the following modes can be selected.

	DSAMP_HT	TRCKMDHT	Clock signal path
Normal mode	L	L	R8541/R8546
Double sampling mode	H	L	R8544/R8545
Track only (autocal)	L	H	R8548/R8549

In normal mode the clock signals are fed from the clock oscillator via R8541 and R8546.

In double sampling mode (double sampling), the signal from path A is not only applied to the T&H in MASPU-A but also via MASPU-B to the second T&H circuit. This causes an additional time delay of about 1.6 ns between the signals which are applied to the two T&H circuits. In order to realize sampling at the correct moment, an additional delay is created between the sample clocks for the two T&H circuits.



This additional clock signal delay is realized via the circuit traces in the current paths of R8544 and R8545 when signal DSAMP_HT is logic "1" and TRACKMDHT is logic "0".

If autocal is performed, the Track & Hold bridges are switched in TRACK ONLY. Signal levels over R8548 and R8549 are then constant.

5.8.1.5 Diagram 5

Analog to Digital Converters

The output signals ANINA and ANINB from the Track and Hold bridges in the Main Analog Signal Processing Units (MASPU's) on diagrams 1 and 2, are applied to the two Analog to Digital Converters ADC N8002 and ADC N8001.
These are 8 bit parallel Flash ADC's with an input range from 0V to -1V (10 divisions on the CRT screen) and with eight ECL outputs. The -0.5V level corresponds with the centre of the CRT screen. Both Flash ADC's are continuously converting at a rate of 100MS/s each. They are continuously clocked by sample-clock signals MCAA/MCNAA and MCBB/MCNBB with a frequency of 100 MHz. Sample rate reduction for different time-base settings is performed in a later stage in the DARLIC circuit on diagram 9.
The converted input signal is latched in the ADC on the negative going edge of the clock signal. Data is converted and available at the ADC outputs after the positive going edge of the clock signal.

ECL-TTL translators

The ECL level (-1.6V [L] and -0.8V [H]) output data signals from the ADC circuits are buffered and converted into TTL level output data signals by the ECL-TTL translator circuits D8004 and D8003.

This results in the databus signals SDA<7:0> and SDB<7:0> on TTL level which can be handled by the DARLIC circuit on diagram 9
The same is done for the sample-clock signals resulting in TTL level SCLKA/SCLKAN and SCLKB/SCLKBN signals which can also be handled by the DARLIC circuit. All data and clock signals are applied to the Data Acquisition and tRigger Logic IC (DARLIC) circuit on diagram 9 for further processing.
All digital data is stored then into a Fast Acquisition Memory (FAM) by the DARLIC after the necessary processing.

5.8.1.6 Diagram 6

Compass input stage

Signals COMP.1N/COMP.1P, COMP.2N/COMP.2P, COMP.3N/COMP.3P and COMP.4N/COMP.4P arrive from the collectors points 1 and 2 of circuits N8023, N8021, N8024 and N8022 on diagram 1. The sensitivity of these signals is 100 µA/division. These input currents are converted into voltage levels over resistors R8341/R8337, R8294/R8301, R8329/R8336 and R8306/R8302 and these voltage levels are applied to the COMparator for Pattern and State Selection circuit (COMPASS) N8029.

Compass offset adjust

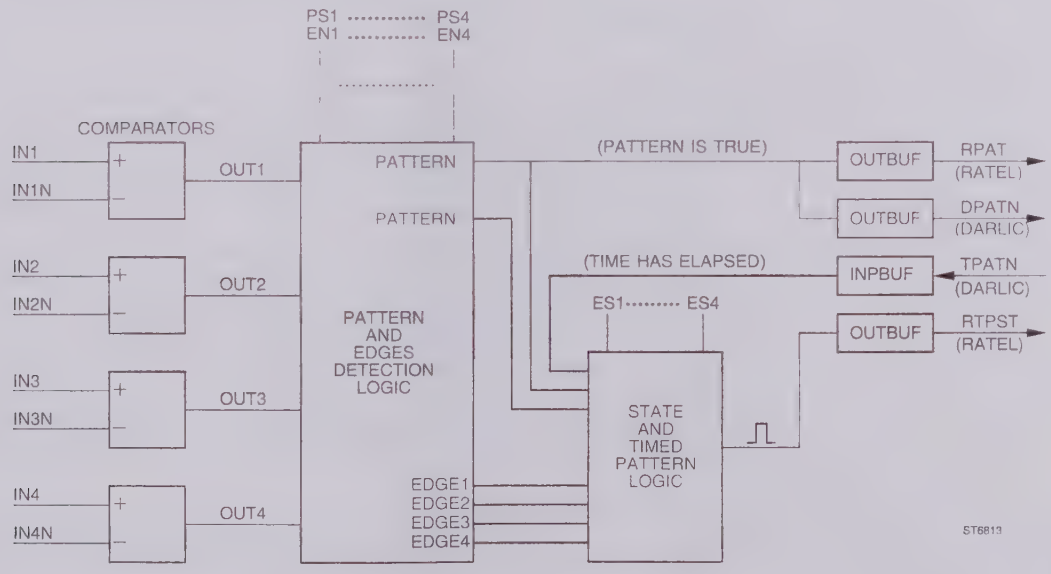
Offset trigger level signals OFFSCMP1, OFFSCMP2, OFFSCMP3 and OFFSCMP4 from the Digital to Analog Converter DACPOT on diagram 3 are applied to opamps N8019 and as CH1FSET, CH2FSET, CH3FSET and CH2FSET applied to the four level shifters V8089/V8091, V8088/V8087, V8082/V8083 and V8086/V8084 together with the four vertical channel input signals. The offset levels OFFSCMP1, OFFSCMP2, OFFSCMP3 and OFFSCMP4 are dependent of the triggerlevel. The output signals are then applied to the COMParator for Pattern and State Selection (COMPASS) circuit N8029.

COMparator for Pattern and State Selection (COMPASS)

With the aid of the COMPASS circuit the number of trigger modes can be extended with three modes, namely:

- PATTERN triggering
- TIMED-PATTERN triggering
- STATE triggering

Simple blockdiagram of the COMPASS circuit:



PATTERN triggering

With PATTERN selected, triggering is possible on a preselected combination of "H", "L" and "X" (don't care) values of the input signals from channel 1 to channel 4.
Triggering on "ENTER" (start of selected pattern) as well as "EXIT" (end of selected pattern) is possible on user request.

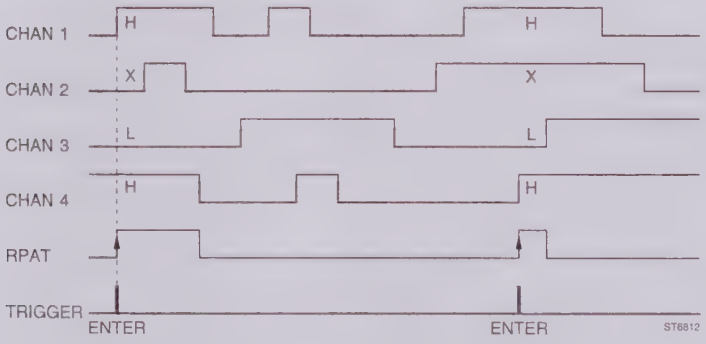
In this mode a logical level will be defined for each input channel signal. This combination of logical levels PS1, PS2, PS3 and PS4 is called a PATTERN and is a condition for triggering. PS1, PS2, PS3 and PS4 are generated via the SBUS (serial bus) on diagram 14.
This user selected pattern is compared with the input signal combination IN1, IN2, IN3 and IN4 in the PATTERN AND EDGES DETECTION LOGIC.
As long as a selected PATTERN condition is true, the PATTERN signal at the output of the PATTERN AND EDGES DETECTION LOGIC becomes active. This signal is via an output buffer applied as symmetrical signal RPAT/RPATN to the Random Trigger Engine Logic circuit (RATEL) circuit on diagram 8 and enables RATEL to generate a trigger. The trigger can be generated on the positive or the negative edge of the pattern, this is selected in the RATEL circuit and is realized by the inversion of signal RPAT.

Example of PATTERN mode:

CHANNEL	1	2	3	4
VALUE	H	X	L	H

L = Logical low
H = Logical high
X = Don't care

Example of input signals and resulting events:



TIMED-PATTERN triggering

With TIMED-PATTERN selected, pattern triggering with a timing condition is possible. This is only possible at the end (EXIT) of a selected pattern. The system has a 10 ns resolution.

The user selected pattern, represented by signals PS1, PS2, PS3 and PS4 is compared with the input signal combination IN1, IN2, IN3 and IN4 in the PATTERN AND EDGES DETECTION LOGIC
These signals PS1, PS2, PS3 and PS4 are generated via the SBUS (serial bus) on diagram 14.
As long as a selected PATTERN condition is true, the PATTERN signal at the output of the PATTERN AND EDGES DETECTION LOGIC becomes active. This signal is via an output buffer applied as low active DPATN to the DARLIC circuit on diagram 9.

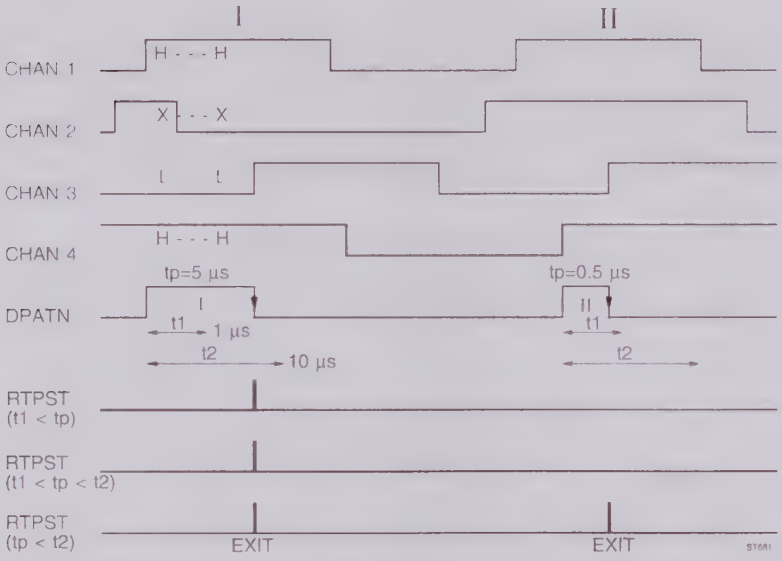
The user selected times t1 and t2 are stored in two counters in the DARLIC circuit on diagram 9. These counters will start counting down after a positive edge of the signal DPATN from the COMPASS circuit, and are presetted on the negative edge of this signal. Signal DPATN is active as long as the selected pattern is present. When the presetted counters have counted down to zero, the selected time has elapsed and the active low signal TPATN is generated. It enables the STATE AND TIMED PATTERN LOGIC which produces an output pulse RTPST at the moment that the pattern has changed. With signal TPATN inactive, no RTPST pulse will be produced at the moment that the pattern has changed.

Example of TIMED-PATTERN mode:

CHANNEL	1	2	3	4
VALUE	H	X	L	H

L = Logical low
H = Logical high
X = Don't care

Example of input signals and resulting events:



There are three different situations possible:

1)	t1 < tp	For pattern I	: true
		For pattern II	: untrue
2)	t1 < tp < t2	For pattern I	: true
		For pattern II	: untrue
3)	tp < t2	For pattern I	: true
		For pattern II	: true

Time tp is the time that the pattern is true.
Times t1 and t2 are user selected times.

STATE triggering

With STATE triggering selected, edge-triggering with pattern- condition is possible. Polarity as well as source are to be selected by the user.

Not only a pattern has to be preselected, but also the trigger channel which completes the pattern. The edge can be selected positive as well as negative.

The circuit is controlled by signal SELTP-HT.
SELTP-HT logic "0" means: STATE-trigger mode selected.
SELTP-HT logic "1" means: PATTERN-trigger mode selected.

The user selected pattern, represented by signals PS1, PS2, PS3 and PS4 is compared with the input signal combination IN1, IN2, IN3 and IN4 in the PATTERN AND EDGES DETECTION LOGIC. These signals PS1, PS2, PS3 and PS4 are generated via the SBUS (serial bus) on diagram 14. As long as a selected PATTERN condition is true, the PATTERN signal at the output of the PATTERN AND EDGES DETECTION LOGIC becomes active. This signal is applied to the STATE AND TIMED PATTERN LOGIC.

In STATE-trigger mode, only one of the signals ES1, ES2, ES3 and ES4 is logic "1". This is the signal that corresponds with the channel that is selected as STATE-clock.

Signals EN1, EN2, EN3 and EN4 carry the "DON'T CARE" information.
A logic "1" means: the corresponding channel is part of the triggerword.
A logic "0" means: the corresponding channel is a "DON'T CARE" for the triggerword.

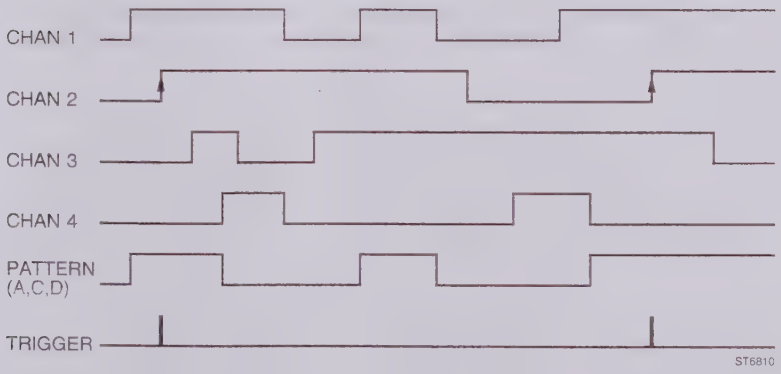
A channel used as STATE-clock in STATE-trigger mode, has to be disabled from the pattern. This means that the relevant EN_ signal must be a logic "0".

Example of settings in STATE mode:

CHANNEL	1	(2)	3	4
VALUE	H	(↑)	X	L

L = Logical low
H = Logical high
X = Don't care
↑ = Positive-going
Channel 2 - POSITIVE EDE

Example of input signals and resulting events:

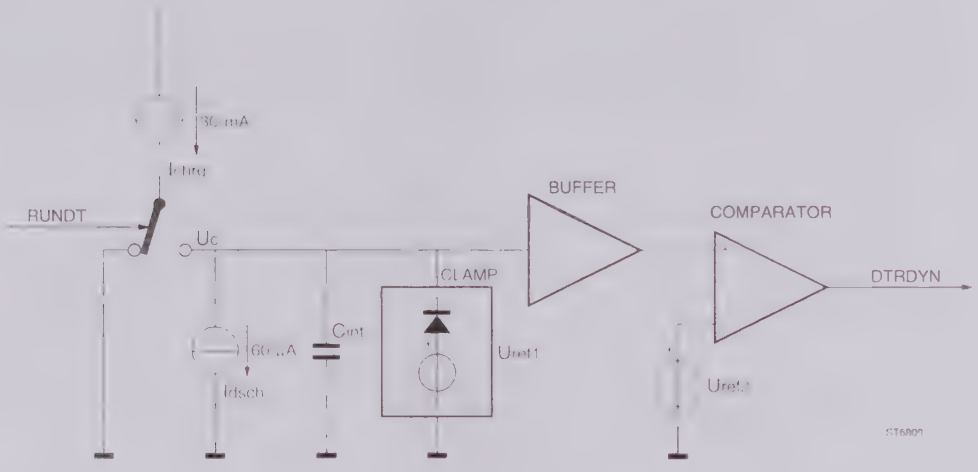


5.8.1.7 Diagram 7

DELTA-T circuit

A DELTA-T circuit is introduced to measure the time between the moment of triggering and the real sample moment. This is needed to know for which memory location converted digital codes have to be stored.

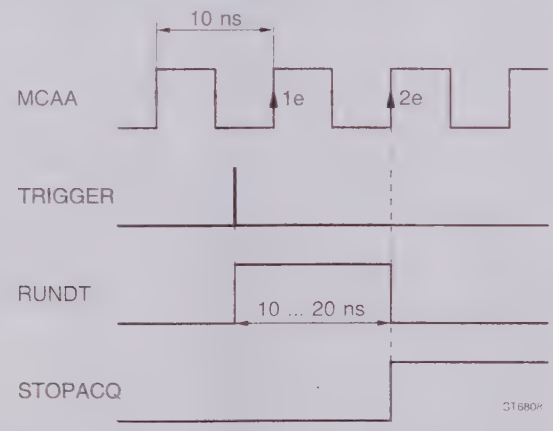
The DELTA-T circuit consists mainly of two current sources. A charge current source (V8044/V8046), which produces a constant current of 30 mA and a discharge current source (V8134/V8136), which produces a constant current of 60 µA. So the ratio between these two currents is 1:500.



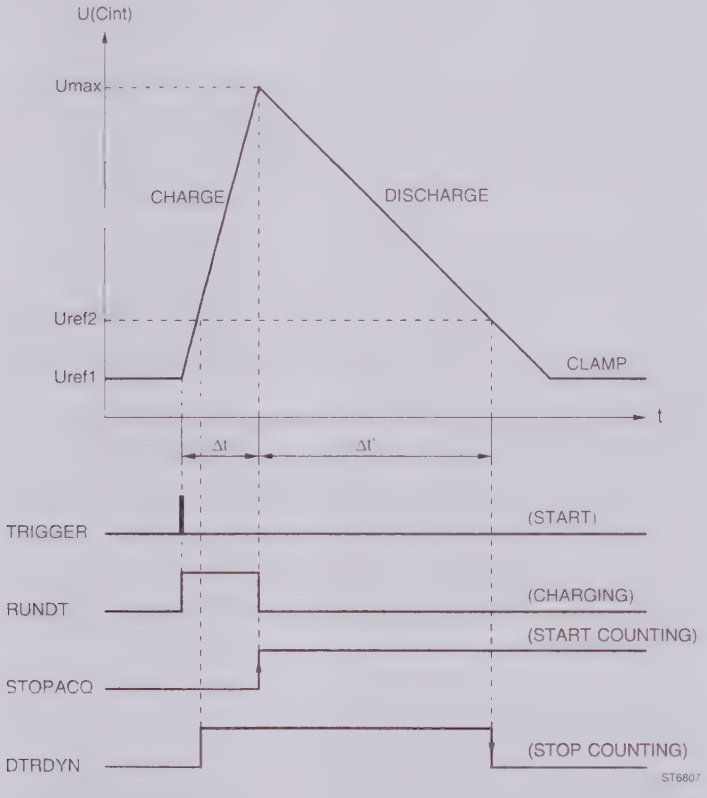
The DELTA-T unit consists of an analog section and a digital section. The digital section in the DARLIC circuit consists of a counter, which runs on the maximum sample clock frequency.

- In direct sampling mode (timebase setting down till 0.25 µs/div.), the DELTA-T circuit is used to keep the position of the triggerpoint on the screen stable (jitter compensation).
- In random sampling mode, more acquisitions are needed to build a complete picture and to fill the complete acquisition memory. The DELTA-T circuit determines the horizontal position for the first sample of each acquisition cycle.

A symmetrical signal pair RUNDT/RUNDTN (RUN delta-T measurement), which is derived from the trigger circuit in the RATEL circuit on diagram 8, controls the DELTA-T measurement.



At the moment that an active trigger signal appears, signal RUNDT switches to logic "1" and transistor V8126 is blocked. Transistor V8124 starts conducting.
Capacitor C8271 is then charged very fast by a current of 30 mA from the charge current source to a voltage which depends on the time between the trigger pulse and the second positive going edge of the 100 MHz clock signal MCAA. .
At the second positive going edge of the clocksignal after the triggermoment, the signal RUNDT is switched to logic "0" again. The transistor V8124 is blocked then and the 30 mA current flows via V8126 which is conducting. Capacitor C8271 will now slowly be discharged to the level Uref1 via the 60 µA discharge current source. The discharge period is 500 times the charge period of the capacitor. The voltage over the capacitor, is applied via buffer V8137 to comparator N8062, where it is compared with reference voltage Uref2.



A DELTA-T counter in the DARLIC circuit is enabled for counting by the STOPACQ signal from the RATEL circuit at the moment that the first sample is taken. So at the second positive going edge of the clocksignal. The counter counts in steps of 10 ns.
The comparator output signal DTRDYN (DELTA-T ready) is applied to the DELTA-T counter in the DARLIC circuit and the falling edge of this signal DTRDYN stops the counting.
At this moment the counter contains a value which is a measure for the time between the trigger pulse and the sample pulse.

The Digital Signal Processor (DSP) circuit on diagram 10 is informed about this completion by an appropriate interrupt bit. After the DSP reads this counter, the counter is reset to zero again, to be ready for the next acquisition cycle and the next DELTA-T measurement.

5.8.1.8 Diagram 8

The RAndom Trigger Engine Logic circuit (RATEL) is a very fast (300MHz) circuit for selection of the source on which triggering takes place. It synchronizes the selected trigger with the 100 MHz system clock. The circuit controls also the DELTA-T circuit by the generation of signal RUNDT.

Trigger source selection

One out of eight trigger sources can be selected via an internal multiplexer, which is controlled by the three source selection signals SLZERO, SLONE and SLTWO.

Trigger source	SLZERO	SLONE	SLTWO
GLITCH (20ns)	0	0	0
DSOM	1	0	0
DSOD	0	1	0
DTB GATE	1	1	0
RTPST	0	0	1
Not used	1	0	1
RPAT	0	1	1
DUAL SLOPE	1	1	1

Input sources for the RATEL circuit D8502 are DTBGATE on X8502, DSOM on X8503 and DSOD on X8501. These signals are derived from the analog oscilloscope section. DSOM is the triggermoment for the Main Time-base, DSOD is the triggermoment for the Delayed Time-base and DTBGATE is active during the delayed sweep.
RPAT/RPATN (pattern trigger mode) and RTPST/RTPSTN (state mode and timed-pattern mode) from the Pattern and State Selector on diagram 6 are also input sources. They are applied to the RATEL circuit via buffers.
Other input sources are GLITCH which is internally derived from RPAT and DUAL SLOPE which is internally derived from DSOM and DSOD.
A GLITCH detection circuit is responsible for generating well defined triggers on small spikes.
The RATEL circuit contains an internal circuit to perform DUAL SLOPE triggering. Dual slope triggering is used in Single Shot mode when it is not known, whether the first signal edge is positive or negative going.

Control signal SLSEL is used for pattern "enter" or "exit" selection by the inversion of signal RPAT. Logic "0" for "enter" and logic "1" for "exit".

Holdoff signal HLONB initializes the RATEL circuit. As long as signal HLONB is logic "0", no new triggers can be processed. Signal HLONB is via a randomizer circuit derived from HLONA to make HLONB asynchronous from the 100 MHz system clock.

Trigger detection and synchronization

The selected trigger signal from the trigger source selector, is internally applied to the trigger detection and synchronization stages.
Here each trigger signal (start of a new acquisition cycle) is synchronized with the 100 MHz sample clocksignal MCAAR. A signal ENEV is then generated as input for the trigger synchronization stage and this results after synchronization in the digital trigger signal STOPACQ.

AUTO trigger mode

If no triggers are present and the DARLIC circuit has seen no triggers (via the alias input) for about 100 ms, the AUTO trigger mode is activated and signal STOPACQ is derived from signal AUTOTRHT which is generated by the software.
A trace is then displayed on the CRT screen.

Event trigger mode

Signal ENEV (enable event) is also used for event counting in Event trigger mode. The clockpulse for the Event mode is signal ECLK.
In the Event mode, the source is DSOD selected by the signals SLEONE ("1") and SLETWO ("0").

Switching between normal and event triggering is done with signal EVENT-HT. Signal ENEV starts an event counter in the DARLIC circuit. This counter will count the selected number of events minus one, after which the EVUFN (event underflow) for the RATEL circuit will be activated. With the last ECLK pulse the EVUFN signal is clocked and applied to the trigger synchronization stage resulting in signal STOPACQ.

TV trigger mode

In TV trigger mode the trigger signal is derived from DSOM and as signal ECLK applied to the circuit consisting of D8045, D8030 and D8063. The circuit is enabled by signal ENDGHOHT (enable digital hold- off), if TV-LINE is selected (analog and digital) or if digital DTB acquisition is selected. D-type flipflop D8045 is enabled by signal TVLNSLHT (TV-line selection) which is active high if TV-LINE is selected (analog and digital).

A hold-off signal TVHOLD on X8504 is generated and applied to the hold-off circuit X6010/D8006 in the analog oscilloscope section. This signal enables the time-base generator so that sweeps can then be initiated.

Stop acquisition signal

The signal STOPACQ is generated and applied to the Data Acquisition and tRigger Logic IC (DARLIC) on diagram 9 to stop the acquisition of new input signal information and to enable the DELTA-T counter. This is done on receipt of the active trigger in the RATEL circuit.
Signal STOPACQB is via a delay circuit as STOPACQ applied to the DARLIC circuit to prevent that this signal switches in the edge of the DARLIC clock signal. The STOPACQ signal is reset by signal RSTACQLT.
After generation of signal STOPACQ, a copy cycle starts to copy the new acquisition data to the Main Acquisition Memory (MAM) on diagram 11 for further processing and display on the CRT screen.

DELTA-T circuit

The RATEL circuit derives the RUNDT/RUNDTN signals (10 ... 20 ns) from the triggersignals and the internal 100 MHz clock, to start and stop the measurements in the DELTA-T circuit. Also see the description of diagram 7.

AUTO calibration

In the calibration mode, the DELTA-T circuit is calibrated in 10 ns and 20 ns under the control of the DARLIC circuit. Signal GENTRGNB sets the RATEL circuit in the calibration mode. Holdoff signal HLONB is made active low.
With SELTRG logic "1" a RUNDT signal of 10 ns is generated for 10 ns calibration and with SELTRG logic "0" a RUNDT signal of 20 ns is generated for 20 ns calibration.

5.8.1.9 Diagram 9

Data Acquisition and tRigger Logic IC (DARLIC)

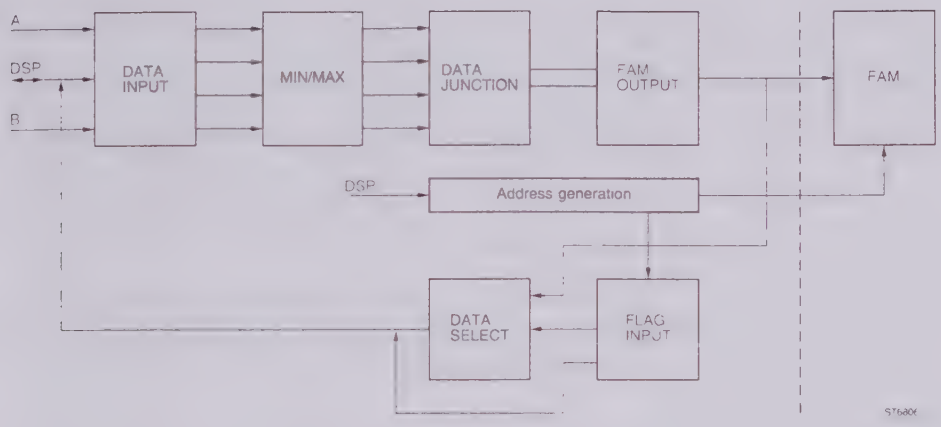
The output datawords SDA<7:0> and SDB<7:0> from the two Analog to Digital Converters on diagram 5 are applied to the DARLIC circuit D8027. The DARLIC circuit is programmed by memory mapped I/O commands.

All tasks can be grouped together in two major functions: a data path and a trigger engine.
The data path is responsible for the total acquisition process from ADC to memory, including time-base generation.
The trigger engine is responsible for the generation of a start/stop acquisition signal that is fed to the data path.

The major headlines of the DATA PATH are:
- Sample clock control via serial data bus.
- Acquisition control and time-base generation. It starts as soon as it is ordered to do so by the Digital Signal Processor (DSP) or system engine. It stops the acquisition as soon as a stopsignal STOPACQ is received from the RATEL circuit.
- Channel switch control via signal SLS12.
- Latching of the 8-bit ADC sample datawords at the maximum sample rate of 100 MS/s and speed conversion from this 100 MS/s data rate to a 25 MHz data rate. This is done by demultiplexing of the two incoming datastreams into four outgoing datastreams for the Fast Acquisition Memory (FAM) behind the DARLIC circuit.
  In the fastest (0,5 µs/div) time-base speed, every 40 ns (25 MHz) four samples will be transferred to the FAM.
- On the fly digital MIN/MAX detection on non stored samples. Each channel has an independent MIN/MAX detector, which detects the minimum and maximum value of all non stored values.
- Gateway function for the data transfer from the Fast Acquisition Memory (FAM) to the Main Acquisition Memory (MAM) by the DSP.

The major headlines of the TRIGGER ENGINE are:
- Generation of a synchronous start/stop acquisition signal for the data path, covering pre- and posttriggering.
- Counting of trigger events and trigger delay.
- It also contains a DELTA-T counter and supports the DELTA-T circuit, to be able to calculate the time between the asynchronous- and the synchronized trigger signal.
- It contains two timers for the timed-pattern mode. Timed- pattern and State detection is realized in combination with the COMPASS circuit on diagram 6.
- Supporting TV line selection in TV trigger mode.

Data path:
The main purpose of the datapath is to establish two gateways. One for guiding the ADC-data to the Fast Acquisition Memory (FAM) in a time-base controlled way, and one for guiding data from the FAM to the Main Acquisition Memory (MAM) by the Digital Signal Processor (DSP).



With the Data Input block a selection between the converted sample data from the two ADCs and data obtained from the Digital Signal Processor (DSP) is made.
Both channels use the clock used by the corresponding ADC. Furthermore the ADC data is checked on underflow and overflow.

With MIN/MAX selected, minimum and maximum values are calculated by the MIN/MAX circuits. This is not possible in the CHOP mode.

A data junction unit lowers the data rate from 100 MHz streams to 25 MHz streams and guides the data from the MIN/MAX circuit properly to output latches. It also starts up the write cycle to the FAM, if enough bytes have been received. It generates the read signal FRDN, the write signal FWRN and the chip select signals FCSN<7:0> for all the memory banks. The FAM itself is not part of the DARLIC circuit.

Besides the creation of data to be stored in the FAM, addresses have to be generated.
The acquired data later has to be transferred to the Main Acquisition Memory (MAM) by means of the Digital Signal Processor (DSP), this can not directly be done but only via the DARLIC gateway in a sequential way.

Trigger engine:
The analog input channels which are connected to the channel switch are also applied to level comparators, see the description of diagram 6. Their outputs are connected to a pattern and state detector. When the pattern matches a predefined pattern mask, a "pattern match" signal DPATN will be generated. A pattern mask is defined, in terms of "H", "L" and "don't care". State triggering is an extension of pattern triggering. One of the channels has to be selected as the clock, the others as qualifiers. The active edge of the clock is selectable.

The result of the detector is asynchronous with the sample-clock and therefor also usable for random sampling. Two timers are available in the DARLIC circuit for use during time measurements. With these timers trigger conditions are defined in terms of trigger on a specific pattern if its present time is T1<TP, or T1<TP<T2, or TP<T2.

The pattern and state detector is mainly realized in the COMPASS circuit, see the description of diagram 6.

Edge selector:
Edges can be used for triggering in general but are a prerequisite for random sampling. The following "edges" are available for the trigger engine:
- DSOM and DSOD signals which come directly from the analog oscilloscope section.
- DTBGATE comes directly from the analog oscilloscope section. The oscilloscope can perform the "triggered DTB" function in the analog as well as in the digital mode.
- Pattern match (including timed pattern) or state detect.
- Glitch detection.
- TV field, frame and TV line. This information is retrieved from the DSOM and the VSYNC incoming signals. VSYNC is an asymmetrical signal applied by connectors and cable with a characteristic input of 50 Ohm.
  A trigger hold-off line, TVHOLD, is returned to the analog oscilloscope section, so that the analog mode of the oscilloscope can be programmed to trigger on a specific TV- line. TVHOLD signal is an asymmetrical signal applied by connectors and cable with a characteristic impedance of 50 Ohm.

Event counting:
Event count is possible on:
- Edges
- Pattern transitions (match/no match)
- Timed patterns (>20 ns)
- State detections

As soon as a predifined number of events are passed and counted by a 16 bit event counter, the event delay phase is terminated. The entry or exit of the event counting phase is asynchronous with the sample-clock. See also the description of diagram 8.

Delay timer:
After the requested trigger is detected and the event delay is passed, it is possible to count down a specific amount of time in a trigger delay counter, to constitute a delay before the acquisition is stopped.

Delta-T Circuit:
The delta-T circuit measures the time between the sample clock and the edge of the output of the "trigger detection circuit". A delta-T counter in the DARLIC circuit is part of the delta-T circuit, see the description of diagram 7.
The measured digital value is applied to the DSP and is be used to position the measured sample values in the Main Acquisition Memory.

Fast Acquisition Memory (FAM):
The acquisition data which is converted by the ADC's, is directly stored in a volatile Fast Acquisition Memory (FAM) by the DARLIC circuit. The access time of this memory is such that it matches the sample speed of the system.
This FAM consists of eight SRAM circuits of 2kx8 each. It can be seen as 2 sets of each 4k words of 8 bits. In single channel mode, these two sets can be combined to 1 set of 8k words of 8 bits. In four channel mode, the two sets can be split up in 4 sets of each 2k words of 8 bits.
The address bus is a fifteen bit bus with lines FA<14:00> and the data bus is an 64 bit bus with lines FD<63:00>. Other memory control lines are the chipselect lines FSCN<7:0> and the output enable line FRDN and read/write line FWRN.
The acquired data has later to be transferred to the Main Acquisition Memory (MAM) by means of the Digital Signal Processor (DSP), this can not directly be done but only via the DARLIC gateway in a sequential way.

A special feature allows the Fast Acquisition Memory to be switched into FIFO (first in first out) mode, in which the acquisition fills, and the DSP empties the Fast Acquisition Memory in a cyclic fashion. This is used in the ROLL-mode.

SBUS system:
The SBUS (serial bus) interface is built-in in the Data Acquisition and tRigger Logic IC (DARLIC) circuit D8027. It is used as an output bus.
The lines are open collector I/O pins, SDA (SerialDAta) and SCL (SerialCLock), and a select line SSEL.
The SBUS is connected to a control signals generator, the dot join circuit and to the intensity control circuit. The SBUS can be controlled by the system engine.
For more detailed information about the serial bus system see section 5.1.1.4.

5.8.1.10 Diagram 10

Digital Signal Processor (DSP):
The Digital Signal Processor D8069 performs all signal processing activities which are not available in hardware. One of the main tasks is the composition of the trace information out of the available registers.
Digital Signal Processor D8069 runs on a 40 MHz clock-frequency from the circuit G8053 signal CK40M.
The DSP contains a 4K maskable PROM and a dataword RAM, of which a part is used for data or program, and the remaining part for data memory.

The functions of the DSP are:
Pre-processing
- Average
- Envelope

Post-processing
- Mathematical functions
- Interpolation (linear, sine)
- Filters

Display memory refresh
X-POSITION control
Restart acquisition
Delta-T processing
Conversion to 512 horizontal dots per screen

Control signals are:
- Three interrupt lines DSPIN0LT, DSPIN1LT and DSPIN2LT.
- The DSP can be reset by signal RSDSP-LT.
- A signal DSPRDYHT to extend the current memory cycle from the DSP until the addressed device is ready to accept data (write cycle) or has put data on the global bus (read cycle).
- DSPRW-LT which is active low during a write cycle and high during a read cycle.
- STRB--LT is a strobe signal which is active low for each external bus cycle.
- DS----LT is a data space select signal which is active low during communication with an external device which contains data.
- PS----LT is a program space select signal which is active low during communication with an external device which contains a program.

Program Memory (PRAM):
The DSP program memory consists of the two 8Kx8 SRAM circuits D8049 and D8052 and is the private program memory of the Digital Signal Processor. It is a volatile memory and can not be accessed by any other device. The address lines are the sixteen lines DSPA<15:00> from the Digital Signal Processor D8069 and the data lines are the sixteen lines DSPD<15:00> to and from the DSP. Control lines for the program memory are the chipselect signal PRAMCSLT, the output enable signal PRAMOELT which is low during read actions, and the read/write signal PRAMRWLT from the Bus Arbiter and Trace Generator (BATGE) circuit on diagram 11.

5.8.1.11 Diagram 11

Bus Arbiter and Trace Generator

The main function of the Bus Arbiter and Trace Generator (BATGE) D8048 is the arbitration between multiple processors, multiple memories and memory mapped I/O with a minimum of interference. This circuit is running on a 40MHz clockfrequency from the circuit G8053, signal CK40M on diagram 10. "Active devices" like the DARLIC circuit for example, generate a "not ready signal".

Text and Trace generation

All texts, cursors and eight traces are generated in vector notation technique.
Text and cursors are generated by means of the Cursor Control CURCON circuit on diagram 12. The 8 traces are generated by the BATGE circuit.
The horizontal resolution will always be 9 bits. Sample values are generated from 1 till 512 which covers the entire available X-axis on the CRT screen and corresponds with 50 dots per division. When the acquisition length is "normal", there is a 1 to 1 relation between the acquisition and the display. When the acquisition length is larger than "normal", then data reduction is necessary to present the entire record on the display. The technic used for data reduction is MIN/MAX detection and works on the principle that on every two positions on the screen the minimum and maximum value of a set of acquisition samples is displayed.
The vertical resolution will always be 10 bits. Sample values are generated from 50 till 950, which covers the entire available Y-axis on the CRT screen.
Also four independent X versus Y traces can be generated in vector notation. These traces are generated by the BATGE circuit. The maximum amount of X-Y dots in a trace is 512.
The Y resolution in X versus Y mode is 10 bits. Sample values are generated from 50 till 950, which covers the entire available Y-axis on the screen.

The trace information can be presented on the CRT screen with normal, highlighted or suppressed light.

The BATGE circuit is also responsible for interconnecting all address, data and control busses of the DSP, SYSTEM BUS, Text and Trace Generator, DARLIC, VECTOR, DACPOT and Main Acquisition Memory.

Main Acquisition Memory (MAM)

The Main Acquisition Memory MAM consists of the two 32Kx8 SRAM circuits D8056 and D8054 and contains the trace data which is ready for display on the CRT screen. It contains an acquisition as well as a display memory.

The memory is non-volatile, which means that the information is not lost when mains supply is turned off.

The address lines are the sixteen GLOBAL ADDRESS BUS lines GLOA<15:0> from the DARLIC circuit on diagram 9 and the data lines are the sixteen GLOBAL DATA BUS lines GLOD<15:0>. Control lines for the program memory are the chipselect signal GLOCS1LT, the output enable signal GLOOE-LT and the read/write signals GLOWELLT and GLOWEHLT from the GLOBAL CONTROL BUS. The Digital Signal Processor can directly access this memory in a random way.
Information from the FAM memory is written to the MAM acquisition memory part.

The display memory contains always the information for one complete screen of 512 dots. Magnification is performed here under software control. In DOTS-mode less than 512 dots can be displayed and in DOTJOIN-mode interpolation between the dots is performed.

Data flow between BATGE and unit A3:

ALE-HT	Adress latch enable ALE-HT = "0" data on CPAD<07:00> ALE-HT = "1" address on CPAD<07:00>
BATRDYHT	Batge ready signal for the wait state logic
BATINTHT	Batge interrupt signal In digital mode, each 16 ms a pulse is generated as indication that text on the CRT display has to be refreshed. Other interrupt events are possible too.
CPA<13:8>	High order address bus
CPAD<07:00>	Multiplexed, bidirectional data/address bus
CPRD--LT	Active low during reading from BATGE by the microprocessor
CPWR--LT	Active low during writing to batge by the microprocessor
RESOPTLT	Reset signal
TXTCS-LT	Active low during main memory access by the microprocessor on unit A3

Data flow between CURCON, VECTOR, INTENS CONTROL, SWITCH CONTROL AND BATGE:

ATXTENLT	Analog text enable signal (generates signal BZ1)
AX<9:0>	10 bits data bus containing the horizontal information of the digital trace for the XDAC
BI0---HT BI1---HT	Signals for intensity control for selection between: - text intensity - intensity in normal mode - intensified intensity
BTEH--HT	Track and hold output for the dot-join circuit
BVEC--HT	Static output signal to VECTOR circuit, determines DOT or DOTJOIN mode. BVEC--HT = "0" dots BVEC--HT = "1" dots joined
BXYSW--HT	Control signal for XY switch BXYSW--HT = "0" analog signals to amplifier BXYSW--HT = "1" digital trace or text to amplifier
BZTE--LT	Vector Z control BZTE--LT = "0" variable intensity of text and digital trace via INTENSITY rotaries on the front of the oscilloscope BZTE--LT = "1" blanking of text and trace
CUEN0-LT	Chip select output signal for CURCON
CZSW1-HT	Z-switch signal from CURCON used for generation of signal BZSW--HT BZSW--HT = "0" analog trace intensity to Z-amplifier BZSW--HT = "1" text or digital trace intensity to Z-amplifier
CZTE1-HT	Curcon Z=text information
CXYSW1HT	XY switch input signal from CURCON
DY<9:0>	10 bits data bus containing the vertical information of the digital trace for the YDAC

Data flow between DSP and BATGE:

DS----LT	Input for data space select, active low during communication with an external data device (for example MAM, DARLIC, DACPOT and so on)
DSPA<15:0>	16 bits DSP address bus
DSPD<15:0>	16 bits DSP data bus
DSPIN1LT	Active low DSP interrupt request output signal
DSPRDYHT	Active low output signal indicating from an external device to the DSP that during a read action for the DSP, the data is not yet placed on the databus or that during a write action from the DSP the data is not yet read by the external device. The DSP then extends the wait cycle and checks the ready signal again.

DSPRW-LT	DSP read/write signal DSPRW-LT = "0" write cycle DSPRW-LT = "1" read cycle
GLOA<16:0>	17 bits global address bus
GLOD<15:0>	16 bits bidirectional global data bus
PRAMCSLT	Active low chip select signal for PRAM
PRAMOELT	Active low output enable signal for PRAM
PRAMRWLT	PRAM read/write signal PRAMRWLT = "0" write cycle to PRAM PRAMRWLT = "1" read cycle from PRAM
PS----LT	Input for program space select, active low during communication with an external program device (for example PRAM)
RSDSP-LT	Active low signal for DSP reset
STRB--LT	Strobe signal, active low during each external bus cycle

Signals from the GLOBAL control bus:

GLOA<16:0>	17 bits global address bus
GLOCS1N	Global chip select 1 for MAM
GLOCS2N	Global chip select 2 (option)
GLOD<15:0>	16 bits bidirectional global data bus
GLOWELLT	Global write low byte enable for devices connected to the low byte of the global data bus
GLOWEHLT	Global write high byte enable for devices connected to the high byte of the global data bus

5.8.1.12 Diagram 12

CURsor CONtrol circuit CURCON

The Cursor Control circuit (CURCON) D8047 is used for cursor and text control. Every 16 ms, an active low signal CUEN0-LT is generated and text and traces are refreshed on the screen and the contents of the memory is read.

Text and cursor control memory

The text and cursor control memory consists of one 8Kx8 SRAM circuit D8051 and contains the text and cursor information to be displayed on the CRT. The address lines are the thirteen lines TXTA<12:0> from the CURsor CONtrol (CURCON) circuit D8047 and the data lines are the eight lines TXTD<7:0> to and from the CURCON circuit.
Control lines for the memory are the chipselect signal, the output enable signal and the read/write signal from the CURCON chip.

X- and Y- Digital to Analog Converters

Digital signal and text data to be displayed is applied as AX<9:0> to the Horizontal Digital to Analog Converter XDAC N8057 and as DY<9:0> to the Vertical Digital to Analog Converter YDAC N8058. The analog output signals XDAC0/XDAC1 and YDAC0/YDAC1 from the two Digital to Analog Converters are applied to the output circuits on diagram 13.
Information for the analog oscilloscope section about switching between the analog and the digital signal information, is derived from signals BXYSW-HT (low is analog signal and high is digital trace and text) and TXTOP-HT via transistors V8041 and V8036 and applied as current signals XYSW0 and XYSW1 to R1204 and R1201 on unit A2. Text display is on during the autocal procedure if TXTOP-HT is high. Switching is done in such a way, that text is mostly displayed in the hold-off period between two sweeps.

Intensity control circuit

All conditions under which the Z-control circuit has to switch the CRT beam ON and OFF are combined in the intensity control circuit. The intensity information comes via the SBUS (serial BUS) to the six channel DAC N8070. Selection between text intensity, trace intensity normal and trace intensity intensified is done in multiplexer D8059 which is controlled by the signals BI0---HT and BI1---HT.

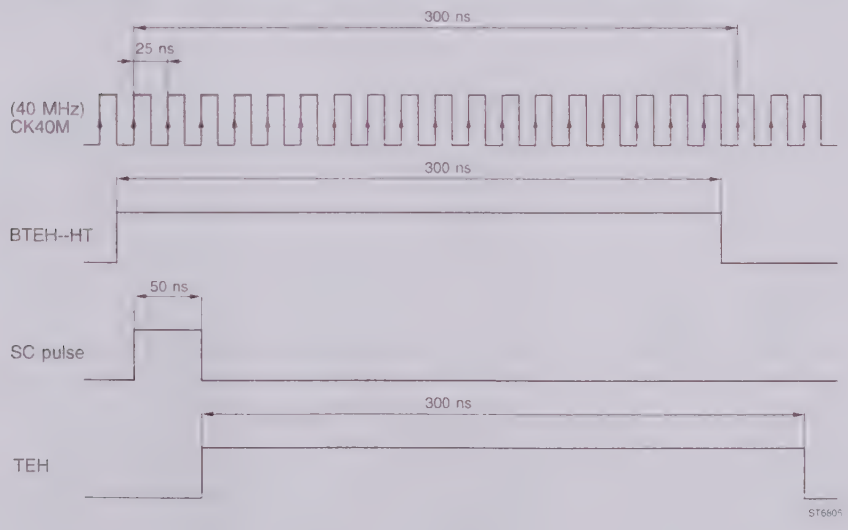
	BI1	BI0
Text intensity	0	0
Normal trace intensity	0	1
Not used	1	0
Intensified intensity	1	1

The selected signal is applied to the base of transistor V8004. Symmetrical Z-control output signal pair ZTXT0 and ZTXT1 carries the resulting blanking/unblanking information which is, applied to R3007 and R3008 on unit A2 in the analog oscilloscope section.
Information for the analog oscilloscope section about switching between the analog Z-signal and the digital Z-signal, is derived from signal BZSW--HT (low is analog trace intensity and high is digital trace and text intensity) via transistors V8042 and V8033 and applied as current signals ZSW0 and ZSW1 to D3001/7 and D3001/8 on unit A2.
Signal BZTE is low for unblanking and high for blanking of the trace. In analog oscilloscope mode, signal BZ1 switches between holdoff (low) and sweep (high). In digital oscilloscope mode this signal switches between text display (low) and trace display (high).

5.8.1.13 Diagram 13

Display interface

Frequency divider:
The 40 MHz input clocksignal CK40M is divided via circuit D8055 into a TEH pulse and a 50 ns SCPULS pulse for the control of the VECTOR (dot join circuit) circuit N8061.



Final offset:
Final offset levels for the X- and Y-axis in the dot join mode, are generated via the SBUS (I2C BUS) and N8009 as levels XOFFS and YOFFS. These levels are via transistors V8201/V8199 and V8203/V8204 applied to the XDAC0/XDAC1 and YDAC0/YDAC1 level signals from the X- and Y-DAC on diagram 12. Resulting X- and Y-signal information is applied to the VECTOR circuit N8061.

Vector circuit:
YDAC0 and YDAC1 as well as XDAC0 and XDAC1 are applied to the vector circuit (dot join circuit) N8061 as symmetrical signals.
The VECTOR circuit is provided with a 2 mA reference current via transistor V8037 and R8384 (signal VECBIAS is not used).
In DOT-mode and during text display, the input signals are directly coupled to the outputs YTXT0/YTXT1 or XTXT0/XTXT1.

The signals YSGPTOUT/YSGNTOUT and XSGPTOUT/XSGNTOUT from level shifters in the VECTOR circuit, are applied to hold capacitors C8256/C8257 and C8258/C8259 during the active TEH pulse of 300 ns. During the SCPULSE of 50 ns, the capacitors are discharged again. Capacitor levels YSGPTSLB/YSGNTSLB and XSGPTSLB/XSGNTSLB are applied to internal voltage/current converters in the VECTOR circuit.

Signal BVEC--HT switches between DOT-mode (0V) and DOTJOIN-mode (5V).
In DOTJOIN-mode the signals are applied via integrator circuits. External capacitors C8102, C8103, C8104 and C8106 are the integrator capacitors for the horizontal signal path and C8107, C8108, C8109 and C8111 are for the vertical signal path.

The integration time to join two dots is 2 microseconds. This is 1 ms per trace of 512 dots and about 8 ms for 8 traces. About 8 ms is used for text display. Each 16 ms a complete new display cycle is performed.

Output signals XTXT0/XTXT1 and YTXT0/YTXT1 are applied to R2063/R2064 and D1001/15, D1001/16 on unit A2 in the analog oscilloscope section for display on the CRT screen.

5.8.1.14 Diagram 14

Control signals via the SBUS (serial BUS) interface

A large number of control signals for the various circuits on digitizer unit A8 are generated via the SBUS interface system and integrated circuits D8034, D8036, D8033 and D8032 which are placed in series.

D8034	ES2	to diagram 6
	ES4	to diagram 6
	PS3	to diagram 6
	PS1	to diagram 6
	SELTRG	to diagram 8
	SELTP-HT	to diagram 6
	ES1	to diagram 6
	ES3	to diagram 6
D8036	EN2	to diagram 6
	EN4	to diagram 6
	PS2	to diagram 6
	PS4	to diagram 6
	EVENT-LT	to diagram 8
	EN1	to diagram 6
	EN3	to diagram 6
D8033	SLZERO	to diagram 8
	SLTWO	to diagram 8
	SLETWO	to diagram 8
	SLEONE	to diagram 8
	SLONE	to diagram 8
	SLSEL	to diagram 8
	CLKBINV	to diagram 4

D8032	ENST13HT	to diagram 1
	PCCDMDLT	to diagram 1 and 2
	CPST13HT	to diagram 1
	DSAMPBHT	to diagram 4
	ENST24HT	to diagram 2
	DSAMPAHT	to diagram 4
	CPST24HT	to diagram 2
	TRCKMDHT	to diagram 4
	HEFOUT	to X1008 on unit A10

Power distribution

Various circuits for filtering of power supply signals as well as splitting and distribution of power supply signals are shown.

5.8.2 Signal name list digitizer A8

NAME	MEANING	SOURCE	DESTINATION
AGADJA	Amplifier gain adjust A	N8014:3	N8026:1
AGADJB	Amplifier gain adjust B	N8014:3	N8027:2
ALE-HT	Address latch enable	X8101:11	D8048:11
ANINA	Analog input A	N8013:1	N8002:5
ANINB	Analog input B	N8012:2	N8001:5
AUTOTRHT	Autotrigger	D8501:3	D8502:8
AX <9:0>	X- digital trace and text data	D8048:11	D8047:12
			N8057:12
BATINTHT	BATGE interrupt	X8101:11	D8048:11
BATRDYHT	BATGE ready	X8101:11	D8048:11
BI0---HT	Intensity control 0	D8048:11	D8059:12
BI1---HT	Intensity control 1	D8048:11	D8059:12
BTEH--HT	Track and hold	D8048:11	D8055:13
BVEC--HT	Vector switch Dots/Dot join	D8048:11	R8530:12
			R8531:12
			N8061:13
			R8853:13
BXYSW-HT	Switch signal Analog/Digital	D8048:11	V8205:12
BZ1	Text enable signal	D8048:11	D8047:12
BZSW--HT	Z-switch signal Analog/Digital	D8048:11	R8422:12
BZTE--LT	Dot Z-control	D8048:11	V8112:12
CHOP1	Chopper signal CH.1	V8047:3	N8026:1
CHOP2	Chopper signal CH.2	V8048:3	N8027:2
CHOP3	Chopper signal CH.3	V8069:3	N8026:1
CHOP4	Chopper signal CH.4	V8071:3	N8027:2
CK12M	Clock signal 12MHz	D8047:12	D8045:3
CK40M	Clock signal 40MHz	G8053:10	D8048:11
			D8055:13
CLKA	Clock signal A (100 MHz)	V8138:4	N8026:1
CLKB	Clock signal B (100 MHz)	V8140:4	N8027:2
CLKBINV	Clock B invert	D8033:14	D8005:4
COMP 1N	Logic input channel 1	N8023:1	R8347:6
COMP 1P	Logic input channel 1	N8023:1	R8344:6
COMP 2N	Logic input channel 2	N8022:2	R8317:6
COMP 2P	Logic input channel 2	N8022:2	R8326:6
COMP 3N	Logic input channel 3	N8024:1	R8291:6

COMP 3P	Logic input channel 3	N8024:1	R8288:6
COMP 4N	Logic input channel 4	N8021:2	R8309:6
COMP 4P	Logic input channel 4	N8021:2	R8316:6
CPA<13:08>	CPU address bus	X8101:11	D8048:11
CPAD<07:00>	CPU multiplexed address/data bus	X8101:11	D8048:11
CPRD--LT	CPU read cycle	X8101:11	D8048:11
CPST13HT	Copy set CH. 1/3 (to CH. 2/4)	D8032:14	N8026:1
CPST24HT	Copy set CH. 2/4 (to CH. 1/3)	D8032:14	N8027:2
CPWR--LT	CPU write cycle	X8101:11	D8048:11
CSD1--LT	Chipselect DARLIC	D8048:11	D8027:9
CUENO-LT	CURCON	D8048:11	D8047:12
CXYSW1HT	CURCON XY switch	D8047:12	D8048:11
CZSW1-HT	CURCON Z switch	D8047:12	D8048:11
CZTE1-HT	CURCON text	D8047:12	D8048:11
D210ENHT	Enable digitizer	D8501:3	X8500:8
DACCS-LT	DACPOT chip select	D8048:11	D8006:3
DACPENLT	DACPOT start cycle	D8501:4	D8006:3
DACSTRTN	DACPOT chip select	D8048:11	D8501:3
DPATN	Pattern valid	R8896:6	D8027:9
DS----LT	Data space select	D8069:10	D8048:11
DSAMPAHT	Double sample mode A	D8032:14	R8547:4
DSAMPBHT	Double sample mode B	D8032:14	R8566:4
DSOD	DTB trigger	X8501:8	D8502:8
DSOM	MTB trigger	X8503:8	D8502:8
DSPA<15:00>	DSP address bus	D8069:10	D8048:11
DSPA15 EX	DSP address bit 15	D8050:10	D8048:11
DSPD<15:00>	DSP bidirectional data bus	D8069:10	D8048:11
DSPIN0LT	DSP interrupt request 0	D8027:9	D8069:10
DSPIN1LT	DSP interrupt request 1	D8048:11	D8069:10
DSPIN2LT	DSP interrupt request 2	D8027:9	D8069:10
DSPRDYHT	DSP ready	D8048:11	D8069:10
DSPRW----LT	DSP read/write	D8069:10	D8048:11
DTBGATE	DTB gate	X8502:8	R8729:8
DTRDYN	Delta-t ready	N8062:7	D8027:9
DY<9:0>	Y digital trace and text data	D8048:11	D8047:12 N8058:12
ECLK	Event clock	R8828:8	D8027:9
ECLKB	Event clock	D8502:8	R8828:8
EN1	Logic don't care CH. 1	D8036:14	N8029:6
EN2	Logic don't care CH. 2	D8036:14	N8029:6
EN3	Logic don't care CH. 3	D8036:14	N8029:6
EN4	Logic don't care CH. 4	D8036:14	N8029:6
ENDGHOHT	Enable digital hold off	D8501:3	D8063:8
ENEV	Enable event	D8502:8	D8027:9
ENPTTMLT	Enable timed pattern	D8501:3	D8503:6
ENST13HT	Enable set 1/3	D8032:14	N8026:1
ENST24HT	Enable set 2/4	D8032:14	N8027:2
ES1	State CH. 1	D8034:14	N8029:6
ES2	State CH. 2	D8034:14	N8029:6
ES3	State CH. 3	D8034:14	N8029:6
ES4	State CH. 4	D8034:14	N8029:6
EVENT-LT	Event mode	D8036:14	D8502:8
EVUFN	Event underflow	D8027:9	D8502:8

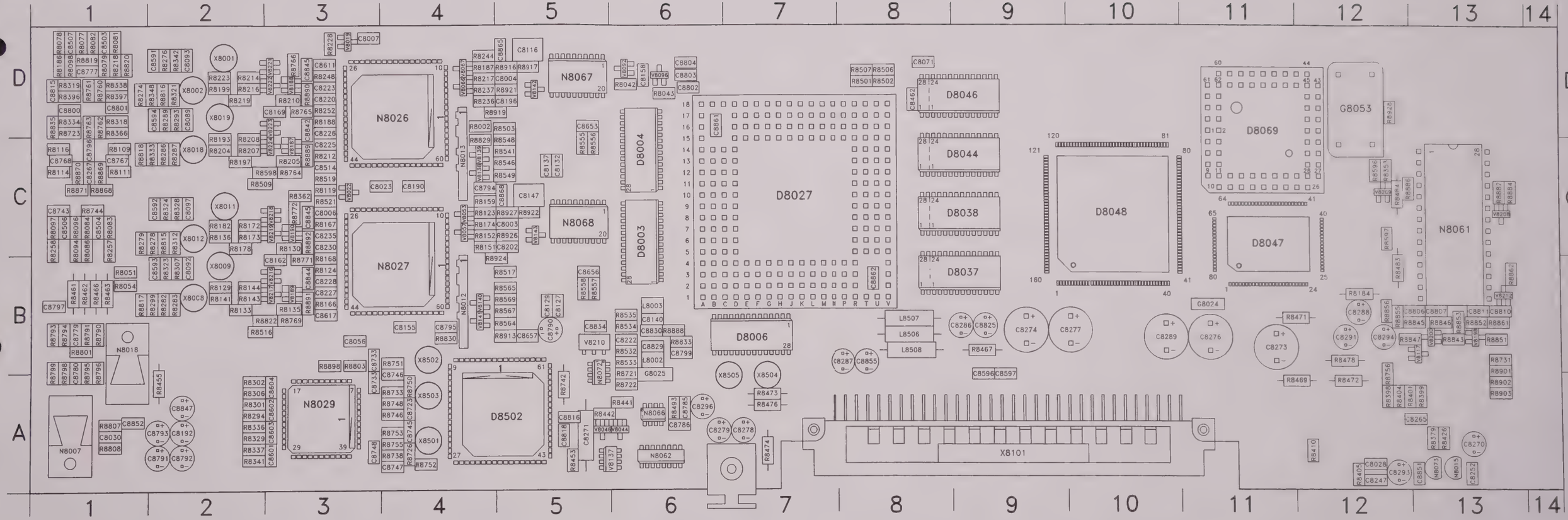
FA<14:00>	FAM adress bus	D8027:9	FAM:9
FAMWRLT	FAM write (2K)	J8001:9	FAM:9
FD<63:00>	FAM data bus	D8027:9	FAM:9
FRDN	FAM read cycle	D8027:9	FAM:9
FSCN<7:0>	FAM chip select	D8027:9	FAM:9
FWRN	FAM write cycle	D8027:9	J8001:9
GAINMPUA	Gain MASPU A	R8778:3	R8079:3
GAINMPUB	Gain MASPU B	R8775:3	R8098:3
GENTRGNB	Generate trigger not	D8027:9	D8502:8
GLOA<16:00>	Global address bus	D8048:11	D8501:3
			D8027:9
			D8047:12
GLOCS1LT	Global chip select 1 (MAM)	D8048:11	D8054:11
			D8056:11
GLOCS1N	Global chip select 1	D8063:11	D8050:11
GLOCS2N	Global chip select 2	D8048:11	D8050:11
			D8063:11
GLOD<15:00>	Global bidirectional data bus	D8048:11	D8006:3
			D8501:3
			D8027:9
			D8047:12
GLOOE-LT	Global bus output enable	D8048:11	D8027:9
			D8047:12
GLORDYHT	Global bus ready (wait state)	D8048:11	D8027:9
			D8047:12
GLOWEHLT	Global bus write enable high byte	D8048:11	D8027:9
			D8047:12
GLOWELLT	Global bus write enable low byte	D8048:11	D8027:9
HEFOUT	HEF bus output	D8032:14	X8101:14
HF1	HF Adjust CH. 1	R8785:3	R8794:3
HF2	HF Adjust CH. 2	R8786:3	R8791:3
HF3	HF Adjust CH. 3	R8787:3	R8795:3
HF4	HF Adjust CH. 4	R8788:3	R8798:3
HFADJ1	HF Adjust CH. 1	R8793:3	R8766:1
HFADJ2	HF Adjust CH. 2	R8790:3	R8772:2
HFADJ3	HF Adjust CH. 3	R8796:3	R8764:1
HFADJ4	HF Adjust CH. 4	R8799:3	R8769:2
HLONA	Holdoff A	D8027:9	D8030:8
HLONB	Holdoff B	D8030:8	D8502:8
INTEGCX	Integrator capacitor X	N8061:13	C8104:13
INTEGCY	Integrator capacitor Y	N8061:13	C8108:13
ITREEA	Supply current for MASPU diode tree	V8014:3	N8026:1
ITREEB	Supply current for MASPU diode tree	V8012:3	N8027:2
MCAA	Clock signal (100 MHz, ECL)	D8005:4	N8002:5
MCAAR	Clock signal (100 MHz, ECL)	R8721:4	D8502:8
MCBB	Clock signal (100 MHz, ECL)	D8005:4	N8002:5
MCNAA	Clock signal (100 MHz, ECL)	D8005:4	D8004:5
MCNAAR	Clock signal (100 MHz, ECL)	R8722:4	D8502:8
MCNBB	Clock signal (100 MHz, ECL)	D8005:4	N8001:5
NCLKA	Clock signal A (100 MHz)	V8138:4	N8026:1
NCLKB	Clock signal B (100 MHz)	V8141:4	N8027:2

OFFSADCA	Offset ADC A	R8783:3	R8111:3
OFFSADCB	Offset ADC B	R8776:3	R8114:3
OFFSCMP1	Logic trigger level control CH. 1	R8782:3	R8762:6
OFFSCMP2	Logic trigger level control CH. 2	R8780:3	R8761:6
OFFSCMP3	Logic trigger level control CH. 3	R8784:3	R8763:6
OFFSCMP4	Logic trigger level control CH. 4	R8781:3	R8760:6
OFFST&HA	Offset track and hold A	R8779:3	R8831:3
OFFST&HB	Offset track and hold B	R8777:3	R8832:3
PCCDINA	For future use	X8016:1	R8187:1
PCCDINB	For future use	X8006:2	R8123:2
PCCDINPA	For future use	X8017:1	R8217:1
PCCDINPB	For future use	X8007:2	R8174:2
PCCDMDLT	For future use	D8032:14	N8026:1 N8027:2
PCCDNA	For future use	X8014:1	N8026:1
PCCDNB	For future use	X8003:2	N8027:2
PCCDPA	For future use	X8013:1	N8026:1
PCCDPB	For future use	X8004:2	R8273:2
POSAA	T&H current source path A	V8081:3	N8026:1
POSAB	T&H current source path A	V8077:3	N8027:2
POSBA	T&H current source path B	V8051:3	N8026:1
POSBB	T&H current source path B	N8074:3	N8027:2
PRAMCSHT	Program RAM chip select	J8003:10	D8049:10
PRAMCSLT	Program RAM select	D8048:11	D8049:10
PRAMOELT	Program RAM output enable	D8048:11	D8049:10
PRAMRWLT	Program RAM read/write	D8048:11	D8049:10
PS1	Pattern select CH. 1	D8034:14	N8029:6
PS2	Pattern select CH. 2	D8036:14	N8029:6
PS3	Pattern select CH. 3	D8034:14	N8029:6
PS4	Pattern select CH. 4	D8036:14	N8029:6
PS----LT	Program space select	D8069:10	D8048:11
RESOPTLT	Reset digitizer	X8101:11	D8027:9 D8048:11 D8047:12
RPAT	Pattern valid	N8029:6	R8747:8
RPATN	Pattern valid	N8029:6	R8734:8
RSDSP-LT	DSP Reset	D8048:11	D8069:10
RSTACQLT	Reset STOPACQ signal	D8501:3	D8502:8
RTPST	Trigger (timed pattern and state)	N8029:6	R8737:8
RTPSTN	Trigger (timed pattern and state)	N8029:6	R8754:8
RUNDT	Run delta-t	D8502:8	R8447:7
RUNDTN	Run delta-t	D8502:8	R8448:7
SADCBNA	Signal copy ADC A to B	N8027:2	N8026:1
SADCBNB	Signal copy ADC A to B	N8026:1	N8027:2
SADCBPA	Signal copy ADC B to A	N8027:2	N8026:1
SADCBPB	Signal copy ADC B to A	N8026:1	N8027:2
SCL	Serial clock	D8027:9	X8500:8 N8070:12 N8009:13 D8032:14 D8033:14 D8034:14 D8036:14

SCLKA	Sample clock A (100 MHz, TTL)	D8004:5	D8027:9
SCLKB	Sample clock B (100 MHz, TTL)	D8003:5	D8027:9
SCLKAN	Sample clock A (100 MHz, TTL)	D8004:5	D8027:9
SCLKBN	Sample clock B (100 MHz, TTL)	D8003:5	C8513:9
SDA	Serial data	D8027:9	X8500:8
			N8070:12
			N8009:13
			D8034:14
SDA<7:0>	Sample data Bus A	D8004:5	D8027:9
SDB<7:0>	Sample data Bus B	D8003:5	D8027:9
SELTP-HT	Select state/pattern	D8034:14	N8029:6
SELTRG	Select trigger	D8034:14	D8502:8
SLEONE	Event source select 1	D8033:14	D8502:8
SLETWO	Event source select 2	D8033:14	D8502:8
SLONE	Trigger source selection 1	D8033:14	D8502:8
SLS12	Chopper clock signal	D8027:9	R8043:3
SLSEL	Slope select	D8033:14	D8502:8
SLTWO	Trigger source selection 2	D8033:14	D8502:8
SLZERO	Trigger source select 0	D8033:14	D8502:8
SSEL	Serial select	R8837:9	R8837:9
			D8032:14
			D8033:14
			D8034:14
			D8038:14
STOPACQ	Stop acquisition	L8513:8	D8027:9
STOPACQB	Stop acquisition	D8502:8	R8887:8
STRB--LT	Strobe, DSP global bus access	D8069:10	D8048:11
TBHOTXT	Time base hold text	X8101:11	R8373:11
TPATN	Timed pattern	D8027:9	D8503:6
TRCKMDHT	Track mode (calibration mode)	D8032:14	R8550:4
			R8563:4
TVHLD	TV Hold	D8027:9	D8045:8
TVHOLD-LD	TV Hold	D8063:8	X8504:8
TVLNSLHT	TV line select	D8501:3	D8045:8
TXTA<12:00>	Text RAM address bus	D8047:12	D8051:12
TXTCS-LT	Chip select	X8101:11	D8048:11
TXTD<7:0>	Text RAM data bus	D8047:12	D8051:12
TXTOP-HT	Text option bit	D8047:12	V8202:12
VADCA	Offset ADC A	R8116:3	R8261:1
VADCB	Offset ADC B	R8109:3	R8112:2
VECBIAS	Vector bias	N8070:12	R8393:13
VSYNC	TV Sync pulse (FRAME)	X8505:9	D8027:9
XDAC0	X DAC output	N8057:12	N8061:13
			V8201:13
XDAC1	X DAC output	N8057:12	N8061:13
			V8199:13
XF---HT	External flag	D8069:10	D8050:10
XOFFS	X offset	N8009:13	R8856:13
XSGNTOUT	Vector difference signal X	N8061:13	V8133:13
XSGNTSLB	Sampled difference signal X	V8133:13	N8061:13
XSGPTOUT	Vector difference signal X	N8061:13	V8129:13
XSGPTSLB	Sampled difference signal X	V8133:13	N8061:13
XTXT0	X digital text and trace output	N8061:13	X8101:13

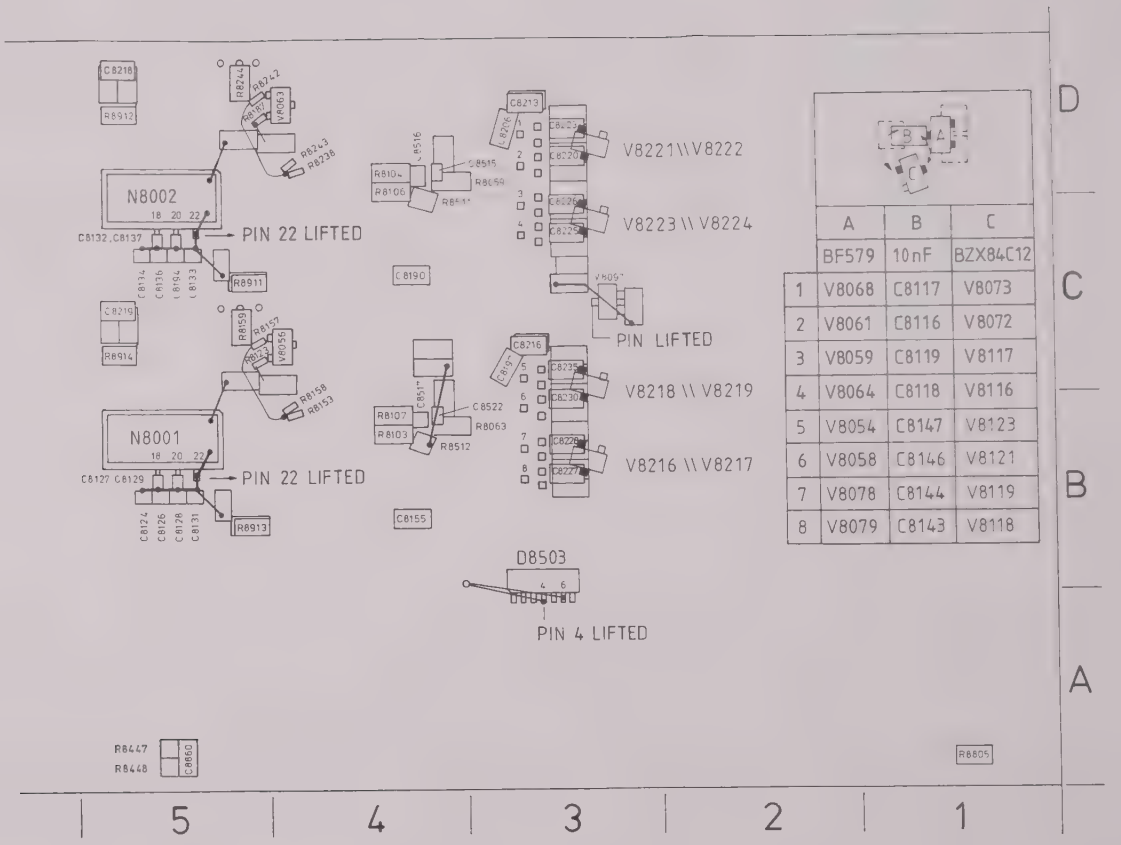
XTXT1	X digital text and trace output	N8061:13	X8101:13
XYSW0	AN/DIG trace switch	V8041:12	X8101:12
XYSW1	AN/DIG trace switch	V8036:12	X8101:12
YDAC0	Y DAC output	N8058:12	N8061:13 V8203:13
YDAC1	Y DAC output	N8058:12	N8061:13 V8204:13
YOFFS	Y offset	N8009:13	R8860:13
YSGNTOUT	Vector difference signal Y	N8061:13	V8132:13
YSGNTSLB	Sampled difference signal Y	V8130:13	N8061:13
YSGPTOUT	Vector difference signal Y	N8061:13	V8131:13
YSGPTSLB	Sampled difference signal Y	V8130:13	N8061:13
YTXT0	Y digital text and trace output	N8061:13	X8101:13
YTXT1	Y digital text and trace output	N8061:13	X8101:13
ZSW0	AN/DIG intensity switch	V8042:12	X8101:12
ZSW1	AN/DIG intensity switch	V8033:12	X8101:12

5.8.3 Unit lay-outs



ST6939
921112

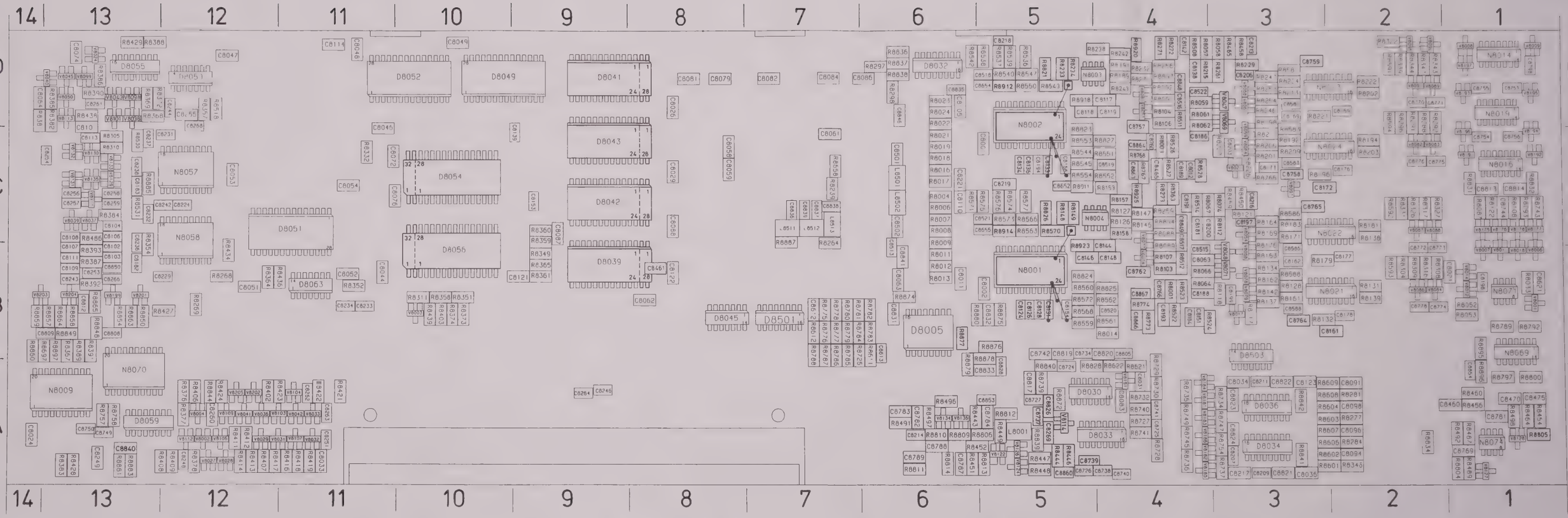
Lay-out 1 - A8 Digitizer, large component side (extension -L)



	A	B	C
	BF579	10nF	BZX84C12
1	V8068	C8117	V8073
2	V8061	C8116	V8072
3	V8059	C8119	V8117
4	V8064	C8118	V8116
5	V8054	C8147	V8123
6	V8058	C8146	V8121
7	V8078	C8144	V8119
8	V8079	C8143	V8118

ST6941
920703

Lay-out 3 - A8 Digitizer, added components (extension-A).



A7p (c1 a2 / a1 c2) BAV99

A4p (a1 a2 / c1 c2) BAV70

e b / c — BC848C : 1Lp
BC858C : 3Lp
BFT93 : X1p
BF579 : LJp
BFS20 : G1p

nc g / c — BZX84-C2V4 : Z11
BZX84-C3V3 : Z14
BZX84-C5V1 : Z2p
BZX84-C5V6 : Z3p

M2p (s d / g) BFR31

a1 a2 / c1 c2 — BBY62 : S4
BAS28 : JTp

M74 (g d / sub s) BSS83

S8p (d g / s) BF512

A3p (nc a / c) BAT17

ST6940
921113

Lay-out 2 - A8 Digitizer, small component side

5.8.4 Location list

Extention -L = Large component side lay-out
No extention = Small component side lay-out

C8001 C5
C8002 B5
C8003 C5-L
C8004 D5-L
C8006 C3-L
C8007 D3-L
C8011 B6
C8012 C4
C8021 B1
C8023 C3-L
C8024 A14
C8026 D8
C8028 A12-L
C8029 C8
C8030 A1-L
C8031 A4
C8033 A11
C8034 A3
C8036 A3
C8044 B11
C8046 D11
C8047 D12
C8048 D11
C8049 D10
C8051 B12
C8052 B11
C8053 C12
C8054 C11
C8056 B3-L
C8058 C8
C8059 C8
C8061 C7
C8062 B8
C8063 B6
C8064 D14
C8071 D8-L
C8072 C11
C8074 D13
C8076 C11
C8079 D8
C8081 D8
C8082 D7
C8083 A4
C8084 D7
C8086 D7
C8087 C9
C8088 C8
C8089 D2-L
C8091 A2
C8092 B2-L
C8093 D2-L
C8094 A2
C8096 A2
C8097 C2-L
C8098 A2
C8101 D13
C8102 B13
C8103 B13
C8104 C13
C8105 D6
C8106 C13
C8107 B13
C8108 C13
C8109 B13
C8110 C6
C8111 B13
C8113 C13
C8114 D11
C8116 D5-L
C8121 B10
C8122 B8
C8123 A3
C8124 B5
C8126 B5
C8127 B5-L
C8128 B5
C8129 B5-L
C8131 B5
C8132 C5-L
C8133 C5
C8134 C5
C8136 C5
C8137 C5-L
C8138 D4
C8139 D9
C8140 B6-L
C8142 D4
C8144 B4
C8146 B5
C8147 C5-L
C8148 B4
C8151 B4
C8153 C9
C8154 B5
C8155 B4-L
C8156 C5
C8158 D6-L
C8159 D2
C8161 B3
C8162 B3
C8169 D2-L
C8172 C3
C8173 D3
C8175 D3
C8176 C2
C8177 B2
C8178 B2
C8179 C3
C8180 B3
C8181 C4
C8182 B13
C8183 C13
C8184 B4
C8186 C4
C8188 B4
C8189 C4
C8190 C4-L
C8191 C4
C8192 A2-L
C8193 B4
C8194 C5
C8196 D5-L
C8197 C3
C8198 B1
C8199 B3
C8200 C4
C8202 C5-L
C8203 C3
C8206 D3
C8207 A3
C8209 A3
C8211 A3
C8213 D3
C8214 A6
C8216 C3
C8217 A3
C8219 C5
C8220 D3-L
C8221 C6
C8222 B6-L
C8223 D3-L
C8224 C12
C8225 C3-L
C8226 C3-L
C8227 B3-L
C8228 B3-L
C8229 B13
C8230 C3-L
C8231 C13
C8232 C13
C8233 B11
C8234 B11
C8235 C3-L
C8236 C13
C8237 C13
C8238 C13
C8242 C13
C8243 B13
C8244 D12
C8246 A9
C8247 A12-L
C8248 A12
C8249 A13
C8251 A11
C8252 A13-L
C8253 B13
C8254 C13
C8255 D12
C8256 C13
C8257 C13
C8258 C13
C8259 C13
C8260 A12
C8261 D13
C8262 A11
C8263 A11
C8264 A9
C8265 A12-L
C8266 B13
C8267 C1-L
C8268 D12
C8269 A5
C8270 A13-L
C8271 A5-L
C8273 B11-L
C8274 B9-L
C8276 B11-L
C8277 B9-L
C8278 A7-L
C8279 A6-L
C8286 B9-L
C8287 B7-L
C8288 B12-L
C8289 B10-L
C8291 B12-L
C8293 A12-L
C8294 B12-L
C8296 A6-L
C8460 A2
C8461 B8

C8462 D8-L
C8465 C4
C8470 A1
C8475 A1
C8501 C6
C8502 C6
C8503 D1-L
C8504 C1-L
C8506 C1-L
C8507 D1-L
C8513 C6
C8514 C3-L
C8515 B4
C8517 C4
C8518 D5
C8520 B4
C8521 C6
C8522 D4
C8581 D3
C8583 C3
C8586 B3
C8588 B3
C8591 D2-L
C8592 C2-L
C8593 B2-L
C8594 D2-L
C8596 A9-L
C8597 A9-L
C8601 A3-L
C8602 A3-L
C8603 A3-L
C8604 A3-L
C8611 D3-L
C8612 B7
C8613 B6
C8617 B3-L
C8621 B1
C8652 C5
C8653 D5-L
C8654 D5
C8655 C6
C8656 B5-L
C8657 B5-L
C8723 A4-L
C8724 A5
C8725 A4
C8726 A5
C8727 A5
C8733 B3-L
C8734 B5
C8737 A5
C8738 A5
C8739 A5
C8740 A4
C8741 A4
C8742 B5
C8743 C1-L
C8744 C1
C8745 A4-L
C8746 A4-L
C8747 A4-L
C8748 A3-L
C8749 A13
C8750 A13
C8753 D1
C8754 C1
C8755 D1
C8756 C1
C8758 C3
C8759 D3
C8762 B4
C8764 B3
C8765 C3
C8766 B4
C8767 C1-L
C8768 C1-L
C8769 A1
C8770 D2
C8771 D2
C8772 B2
C8773 B2
C8774 B2
C8775 C2
C8776 C2
C8777 D1-L
C8778 B2
C8779 B1-L
C8780 A1-L
C8781 A1
C8782 A6
C8783 A6
C8784 A5
C8785 A6-L
C8786 A6-L
C8787 A6
C8788 A6
C8789 A6
C8790 A5-L
C8791 A2-L
C8792 A2-L
C8793 A2-L
C8794 C4-L
C8795 B4-L
C8796 C1-L
C8797 B1-L
C8798 D1
C8799 B6-L
C8800 D1-L
C8801 D1-L
C8802 D6-L
C8803 D6-L
C8804 D6-L
C8805 B4
C8806 B12-L
C8807 B13-L
C8808 B13
C8809 B14
C8810 B13-L
C8811 B13-L
C8812 B13
C8813 C1
C8814 C1
C8815 D1-L
C8816 A5-L
C8817 A5
C8818 A5-L
C8819 B5
C8820 B4
C8821 A3
C8822 A3
C8823 A3
C8824 A3
C8825 B9-L
C8826 A5
C8828 B5
C8829 B6-L
C8830 B6-L
C8831 B6
C8832 B5
C8833 A6
C8834 B5-L
C8835 D6
C8836 C7
C8837 C7
C8838 C7
C8839 C7
C8840 A13
C8841 B6
C8842 C3-L
C8844 B3-L
C8845 C3-L
C8846 D6
C8847 A2-L
C8849 C4
C8850 B13
C8851 A13-L
C8852 A1-L
C8853 A5
C8854 B1
C8855 B8-L
C8860 A5
C8861 D6-L
C8862 B8-L
C8863 C4
C8864 C4
C8865 D5-L
C8866 B4
C8867 B4
C8868 C5-L
D8003 B6-L
D8004 C6-L
D8005 B6
D8006 B7-L
D8027 C7-L
D8030 A5
D8032 D6
D8033 A5
D8034 A3
D8036 A3
D8037 B8-L
D8038 C8-L
D8039 B9
D8041 D9
D8042 C9
D8043 C9
D8044 C8-L
D8045 B8
D8046 D8-L
D8047 C11-L
D8048 C10-L
D8049 D10
D8050 D12
D8051 C11
D8052 D10
D8054 C10
D8055 D13
D8056 B10
D8059 A13
D8063 B11
D8069 D11-L
D8501 B7
D8502 A4-L
D8503 B3
G8024 B11-L
G8025 A6-L
G8053 D12-L
L8001 A5
L8002 B6-L
L8003 B6-L
L8501 C6
L8502 C6
L8506 B8-L
L8507 B8-L
L8508 B8-L
L8511 C7
L8512 C7
L8513 C7
N8001 B5
N8002 D5
N8004 C5
N8007 A1-L
N8009 A13
N8012 B4-L
N8013 C4-L

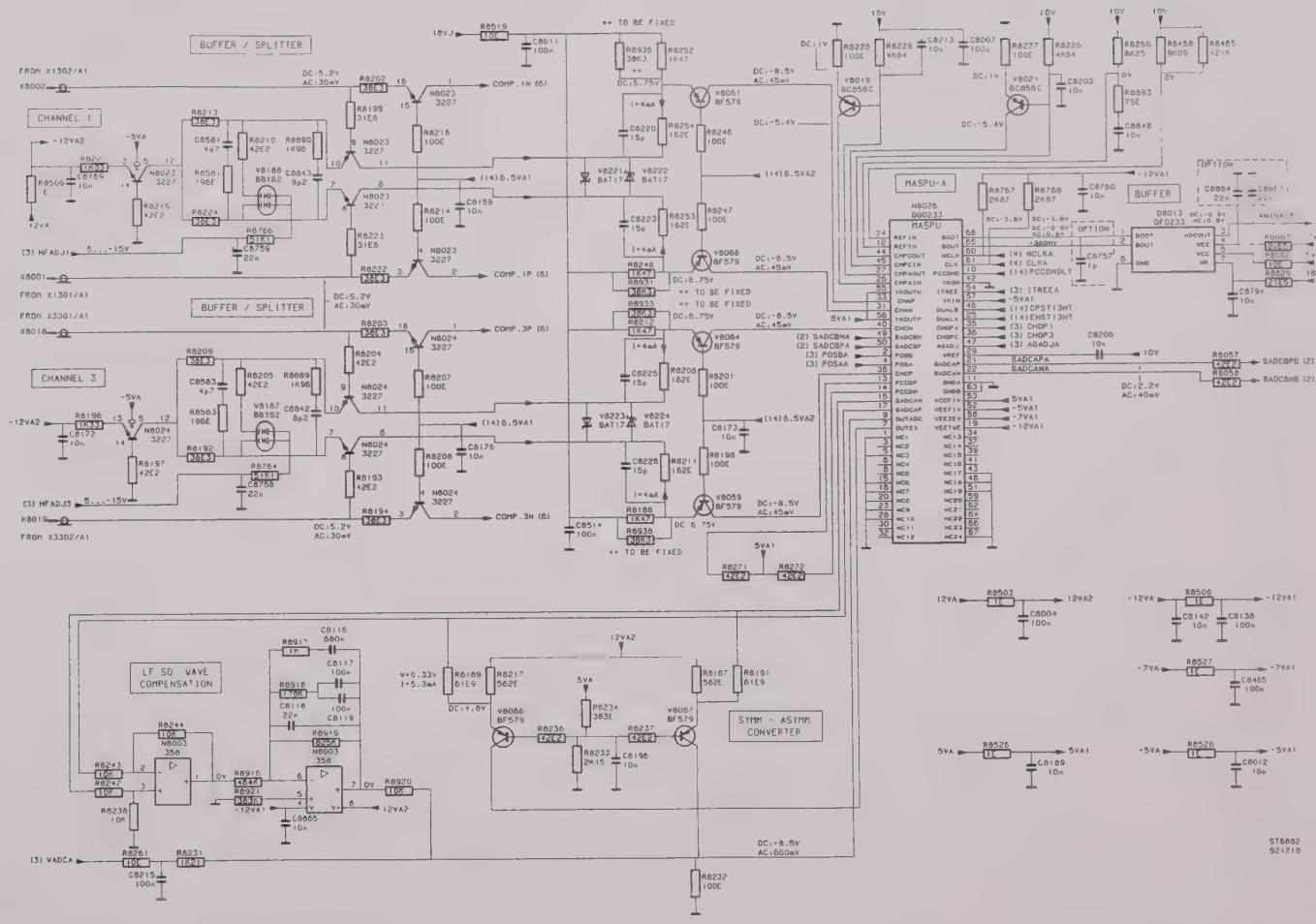
N8014 D1
N8015 A13-L
N8016 C1
N8018 B1-L
N8019 D1
N8021 B3
N8022 C3
N8023 D3
N8024 C3
N8026 D3-L
N8027 B3-L
N8029 A3-L
N8057 C12
N8058 C12
N8061 C13-L
N8062 A6-L
N8066 A6-L
N8067 D5-L
N8068 C5-L
N8069 B1
N8070 A13
N8071 B1
N8072 A5-L
N8073 A13-L
N8074 A1
R8001 B4
R8002 D4-L
R8003 C4
R8004 C6
R8006 C6
R8007 C6
R8008 C6
R8009 C6
R8011 B6
R8012 B6
R8013 B6
R8014 B4
R8016 C6
R8017 C6
R8018 C6
R8019 C6
R8021 C6
R8022 D6
R8023 D6
R8024 D6
R8033 B1
R8042 D6-L
R8043 D6-L
R8051 B1-L
R8052 B1
R8053 B1
R8054 B1-L
R8057 D4
R8058 D3
R8059 D4
R8061 D4
R8062 D4
R8064 B4
R8066 B4
R8067 C4
R8074 C3
R8077 D1-L
R8078 D1-L
R8079 D1-L
R8081 D1-L
R8082 D1-L
R8083 C1-L
R8084 C1-L
R8086 B1-L
R8087 C1
R8088 C4
R8089 C4
R8091 D4
R8092 D4
R8093 C1
R8094 B1-L
R8096 C1-L
R8097 C1-L
R8098 D1-L
R8103 B4
R8104 D4
R8106 D4
R8107 B4
R8108 C1
R8109 C1-L
R8111 C1-L
R8112 C3
R8114 C1-L
R8116 C1-L
R8117 B3
R8118 B3
R8119 C3-L
R8121 C3
R8122 C1
R8123 C4-L
R8124 B3-L
R8126 C4
R8127 C4
R8128 B3
R8129 B2-L
R8130 C3-L
R8131 B2
R8132 B3
R8133 B2-L
R8134 B3
R8135 B3-L
R8136 C2-L
R8137 B3
R8138 C2
R8139 B2
R8141 B2-L
R8142 B3
R8143 B2-L
R8144 B2-L
R8146 C4
R8147 C4
R8148 C5
R8149 C5
R8151 C4-L
R8152 C4-L
R8153 C4
R8157 C4
R8158 C4
R8159 C4-L
R8161 B3
R8162 B3
R8163 B3
R8164 C3
R8166 B3-L
R8167 C3-L
R8168 B3-L
R8169 C3
R8171 C3
R8172 C2-L
R8173 C2-L
R8174 C4-L
R8176 C3
R8178 C2-L
R8179 B3
R8181 C2
R8182 C2-L
R8183 C3
R8184 B12-L
R8186 D1-L
R8187 D4-L
R8188 C3-L
R8189 D4
R8191 D4
R8192 C3
R8193 D2-L
R8194 C2
R8196 C3
R8197 C2-L
R8198 D3
R8199 D2-L
R8201 C3
R8202 D2
R8203 C2
R8204 C2-L
R8205 C3-L
R8206 C3
R8207 C2-L
R8208 D2-L
R8209 C3
R8210 D3-L
R8211 C3
R8212 C3-L
R8213 D3
R8214 D2-L
R8215 D4
R8216 D2-L
R8217 D4-L
R8218 D1-L
R8219 D2-L
R8221 D3
R8222 D2
R8223 D2-L
R8224 D3
R8226 C3
R8227 C3
R8228 D3-L
R8229 D3
R8231 D4
R8232 D4
R8233 D5
R8234 D5
R8236 D4-L
R8237 D4-L
R8238 D5
R8239 C7
R8242 D4
R8243 D4
R8244 D4-L
R8246 D3
R8247 D3
R8248 D3-L
R8252 D3-L
R8253 D3
R8254 D3
R8256 D4
R8257 B1-L
R8258 B1-L
R8259 C4
R8261 D3
R8264 C7
R8268 B12
R8269 B12
R8271 D4
R8272 D4
R8273 C4
R8274 D1-L
R8276 D2-L
R8277 A2
R8278 C2-L
R8279 B1-L
R8281 A2
R8282 B2-L
R8283 B2-L
R8284 A2
R8286 C2-L
R8287 C2-L
R8288 D2
R8289 D2-L
R8291 D2

R8292 D2
R8293 D2-L
R8294 A2-L
R8296 D2
R8297 D6
R8298 D6
R8299 B2-L
R8301 A2-L
R8302 A2-L
R8304 B2
R8305 C13
R8306 A2-L
R8307 B2-L
R8308 B2
R8309 B2
R8310 C13
R8311 B10
R8312 C2-L
R8316 B2
R8317 C2
R8318 D1-L
R8319 D1-L
R8321 D2-L
R8322 D2
R8323 B2-L
R8324 C2-L
R8326 C2
R8327 C2
R8328 C2-L
R8329 A2-L
R8331 C2
R8332 C11
R8333 C2-L
R8334 D1-L
R8336 A2-L
R8337 A2-L
R8338 D1-L
R8339 D2
R8341 A2-L
R8342 D2-L
R8343 D2
R8344 D2
R8346 A2
R8347 D2
R8348 D2-L
R8349 B9
R8351 B10
R8352 B11
R8353 C12-L
R8354 C13
R8357 D12
R8358 B10
R8359 C9
R8360 C9
R8361 B9
R8362 C3-L
R8363 C4
R8364 B12
R8365 B9
R8366 C1-L
R8367 B13
R8368 D13
R8369 D13
R8372 D13
R8373 B10
R8374 B10
R8376 A12
R8377 A12
R8378 A12
R8379 A13-L
R8381 D14
R8382 D13
R8383 A13
R8384 C13
R8385 D13
R8386 D13
R8387 B13
R8388 D13
R8389 B13
R8390 D13
R8391 B13
R8392 B13
R8393 B13
R8396 D1-L
R8397 D1-L
R8398 A12-L
R8399 A13-L
R8401 A12-L
R8402 A12
R8403 B10
R8404 A12-L
R8405 A12-L
R8406 A12
R8407 A12
R8408 A12
R8409 A12
R8410 A12-L
R8411 A12
R8412 A12
R8413 A12
R8414 A12
R8416 A11
R8417 A12
R8418 A11
R8419 A11
R8421 A11
R8422 A11
R8423 A11
R8424 A12
R8426 A13-L
R8427 B13
R8428 A13
R8429 D13
R8434 C12
R8436 B11
R8438 D13
R8439 B10
R8441 A6-L
R8442 A5-L
R8443 A6
R8444 A5
R8446 A5
R8447 A5
R8448 A5
R8449 A5
R8450 C3
R8451 A6
R8452 A6
R8453 A5-L
R8454 A1
R8455 A2-L
R8456 A1
R8458 D3
R8459 C3
R8460 A1
R8461 B1-L
R8462 B1-L
R8463 B1-L
R8464 A1
R8465 D3
R8466 B1-L
R8467 B9-L
R8469 A11-L
R8471 B11-L
R8472 A12-L
R8473 A7-L
R8474 A7-L
R8476 A7-L
R8478 B12-L
R8483 B12-L
R8484 C12-L
R8486 C13
R8487 A1
R8489 A1
R8491 A6
R8492 A1
R8493 A6-L
R8496 A6
R8497 A6
R8498 A1
R8501 D8-L
R8502 D8-L
R8503 D5-L
R8506 D8-L
R8507 D8-L
R8508 D4
R8509 C2-L
R8511 D4
R8512 B4
R8513 B4
R8514 C4
R8516 B2-L
R8517 B5-L
R8518 D12
R8519 C3-L
R8521 C3-L
R8522 B4
R8523 B4
R8524 B4
R8526 C4
R8527 C4
R8528 C4
R8530 C13
R8531 C13
R8532 B6-L
R8533 B6-L
R8534 B6-L
R8535 B6-L
R8536 D5
R8537 D5
R8538 D5
R8539 D5
R8540 D5
R8541 C5-L
R8542 D6
R8543 D5
R8544 C5
R8545 C5
R8546 C5-L
R8547 D5
R8548 C5-L
R8549 C5-L
R8550 D5
R8551 C4
R8552 C4
R8553 C5
R8554 C5
R8555 C5-L
R8556 C5-L
R8557 B5-L
R8558 B5-L
R8559 B5
R8560 B5
R8561 B4
R8563 C5
R8564 B5-L
R8565 B5-L
R8566 C5
R8567 B5-L
R8568 B5
R8569 B5-L
R8570 C5
R8571 C6
R8572 B5

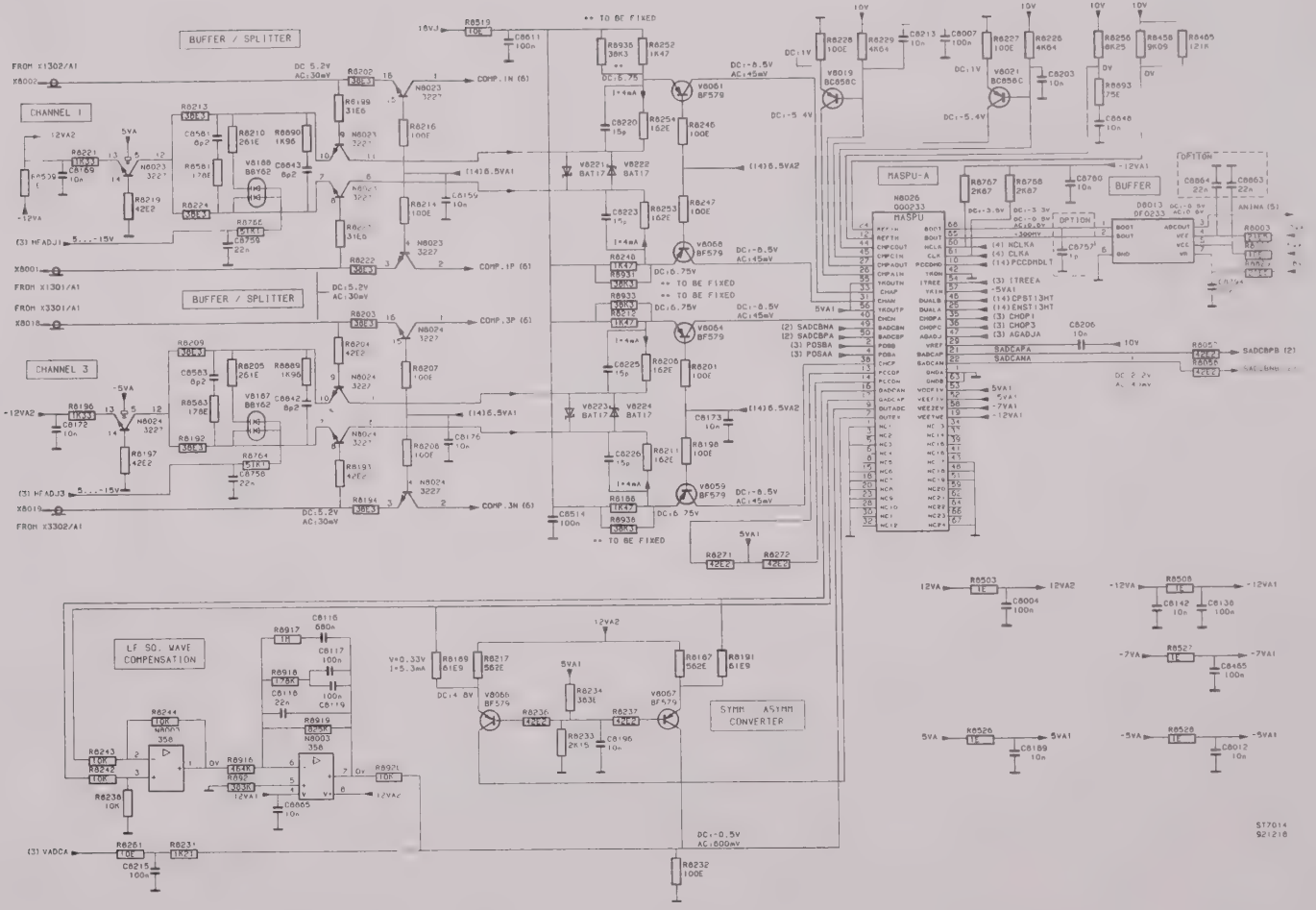
R8573 C5
R8574 C5
R8575 C5
R8576 C5
R8577 C5
R8581 D3
R8583 C3
R8586 C3
R8588 B3
R8591 D2
R8592 C2
R8593 B2
R8594 D2
R8596 C12-L
R8597 C12-L
R8598 C2-L
R8601 A3
R8602 A3
R8603 A3
R8604 A3
R8606 A3
R8607 A3
R8608 A3
R8609 A3
R8611 B6
R8612 B7
R8621 A4
R8622 A4
R8658 C7
R8697 B13
R8721 A6-L
R8722 A6-L
R8723 D1-L
R8725 B7
R8726 A4-L
R8727 A4
R8728 A4
R8729 B4
R8730 A4
R8731 B13-L
R8732 A4
R8733 A4-L
R8734 A3
R8735 A4
R8736 A4
R8737 A3
R8738 A4-L
R8739 A5
R8740 A4
R8741 A4
R8742 A5-L
R8743 C1
R8744 C1-L
R8745 A4
R8746 A4-L
R8747 A3
R8748 A4-L
R8749 A4
R8750 A4-L
R8751 A4-L
R8752 A4-L
R8753 A4-L
R8754 A3
R8755 A4-L
R8756 A12-L
R8757 A13
R8758 A13
R8760 D1-L
R8761 D1-L
R8762 D1-L
R8763 D1-L
R8764 C3-L
R8765 D3-L
R8766 D3-L
R8767 C4
R8768 C4
R8769 B3-L
R8771 B3-L
R8772 C3-L
R8773 B4
R8774 B4
R8775 B7
R8776 B7
R8777 B7
R8778 B7
R8779 B7
R8780 B7
R8781 B7
R8782 B6
R8783 B6
R8784 B7
R8785 B7
R8786 B7
R8787 B7
R8788 B7
R8789 B1
R8790 B1-L
R8791 B1-L
R8792 B1
R8793 B1-L
R8794 B1-L
R8795 A1-L
R8796 A1-L
R8797 A1
R8798 A1-L
R8799 A1-L
R8800 A1
R8801 B1-L
R8802 A3-L
R8803 A3-L
R8804 A1
R8805 A1
R8806 A6
R8807 A1-L
R8808 A1-L
R8809 A6
R8810 A6
R8811 A6
R8812 A5
R8813 A5
R8814 A6
R8815 B2-L
R8816 D2-L
R8817 B1-L
R8818 C1-L
R8819 D1-L
R8820 D1-L
R8821 D5
R8822 B2-L
R8823 C5
R8824 B5
R8825 B4
R8826 C5
R8827 C4
R8828 A5
R8829 C4-L
R8830 B4-L
R8831 C1
R8832 C1
R8833 B6-L
R8834 A2
R8835 D1-L
R8836 D6
R8837 D6
R8838 D6
R8839 A5
R8840 A5
R8841 A3
R8842 A3
R8843 B13-L
R8844 A12
R8845 B12-L
R8846 B13-L
R8847 B12-L
R8848 B13
R8849 B13
R8850 B13
R8851 B13-L
R8852 B13-L
R8853 B13-L
R8854 B13
R8855 B12-L
R8856 B12-L
R8857 B13
R8858 B13
R8859 B14
R8860 B14
R8861 B13-L
R8862 B13-L
R8863 B13
R8864 B13
R8865 B13
R8866 D4
R8867 C4
R8868 C1-L
R8869 C1-L
R8870 C1-L
R8871 C1-L
R8872 A5
R8874 B6
R8875 B5
R8876 B5
R8877 B6
R8878 B6
R8879 B6
R8880 B6
R8881 A13
R8882 C13-L
R8883 A13
R8884 C13-L
R8885 C13
R8886 C13-L
R8887 C7
R8888 B6-L
R8889 C3-L
R8890 D3-L
R8891 B3-L
R8892 C3-L
R8893 D4
R8894 C4
R8895 B1
R8896 B1
R8897 B13
R8898 A3-L
R8901 B13-L
R8902 A13-L
R8903 A13-L
R8911 C5
R8912 D5
R8913 B5-L
R8914 C5
R8916 D5-L
R8917 D5-L
R8918 D5
R8919 D4-L
R8920 D4
R8921 D5-L
R8922 C5-L
R8923 B5
R8924 B4-L
R8925 C4
R8926 C5-L
R8927 C5-L
R8928 D12-L

V8001 B1
V8002 A12
V8003 B10
V8004 A12
V8006 B1
V8007 B1
V8008 D1
V8009 D1
V8011 B1
V8012 B1
V8014 B1
V8017 B3
V8018 B1
V8019 D3-L
V8021 C3
V8022 C3-L
V8024 D13
V8027 A12
V8028 A12
V8029 A12
V8031 A12
V8032 A11
V8033 A11
V8036 A12
V8037 C13
V8038 D13
V8039 C13
V8040 D13
V8041 A12
V8042 A11
V8043 D13
V8044 A6-L
V8045 D13
V8046 A5-L
V8047 D3
V8048 B3
V8050 D13
V8051 D4
V8053 C4-L
V8054 C3
V8057 C4-L
V8058 B3
V8059 D3
V8061 D3
V8064 C3
V8066 D4-L
V8067 D4-L
V8068 D3
V8069 D3
V8071 B3
V8074 B4
V8077 C4
V8078 B3
V8079 B3
V8081 D4
V8082 C2
V8083 C2
V8084 B2
V8086 B2
V8087 C2
V8088 C2
V8089 D2
V8090 D2
V8091 D2
V8092 D6-L
V8095 D2
V8096 D6-L
V8097 C3
V8098 D13
V8099 D13
V8101 D13
V8103 A12
V8104 A11
V8106 A12
V8107 A11
V8109 A12
V8111 C13
V8112 A12
V8113 D13
V8114 A5
V8117 B13-L
V8122 A5
V8124 A5
V8126 A5
V8127 A1
V8128 A1
V8129 C13
V8130 C13
V8131 C13
V8132 C13
V8133 C13
V8134 A6
V8135 C13
V8136 A6
V8137 A5-L
V8138 C4-L
V8139 C4-L
V8140 B4-L
V8141 B4-L
V8142 D5-L
V8143 C5-L
V8151 A4
V8175 C1
V8176 C1
V8177 C1
V8178 C1
V8181 A4
V8182 A4
V8183 A4
V8184 A4
V8185 A4
V8186 A4
V8187 C3-L
V8188 D3-L
V8189 B3-L
V8190 C3-L
V8191 C1
V8192 C1
V8193 D1
V8194 C1
V8195 D1
V8196 C1
V8197 D1
V8198 B13-L
V8199 B13
V8200 B13-L
V8201 B13
V8202 A12
V8203 B14
V8204 B13
V8205 A12
V8208 C13-L
V8209 C12-L
V8210 B5-L
V8212 B13-L
V8216 B3-A
V8217 B3-A
V8218 C3-A
V8219 C3-A
V8221 D3-A
V8222 D3-A
V8223 C3-A
V8224 C3-A
X8001 D2-L
X8002 D2-L
X8008 B2-L
X8009 B2-L
X8011 C2-L
X8012 C2-L
X8018 C2-L
X8019 D2-L
X8101 A9-L
X8501 A4-L
X8502 A4-L
X8503 A4-L
X8504 A7-L
X8505 A6-L

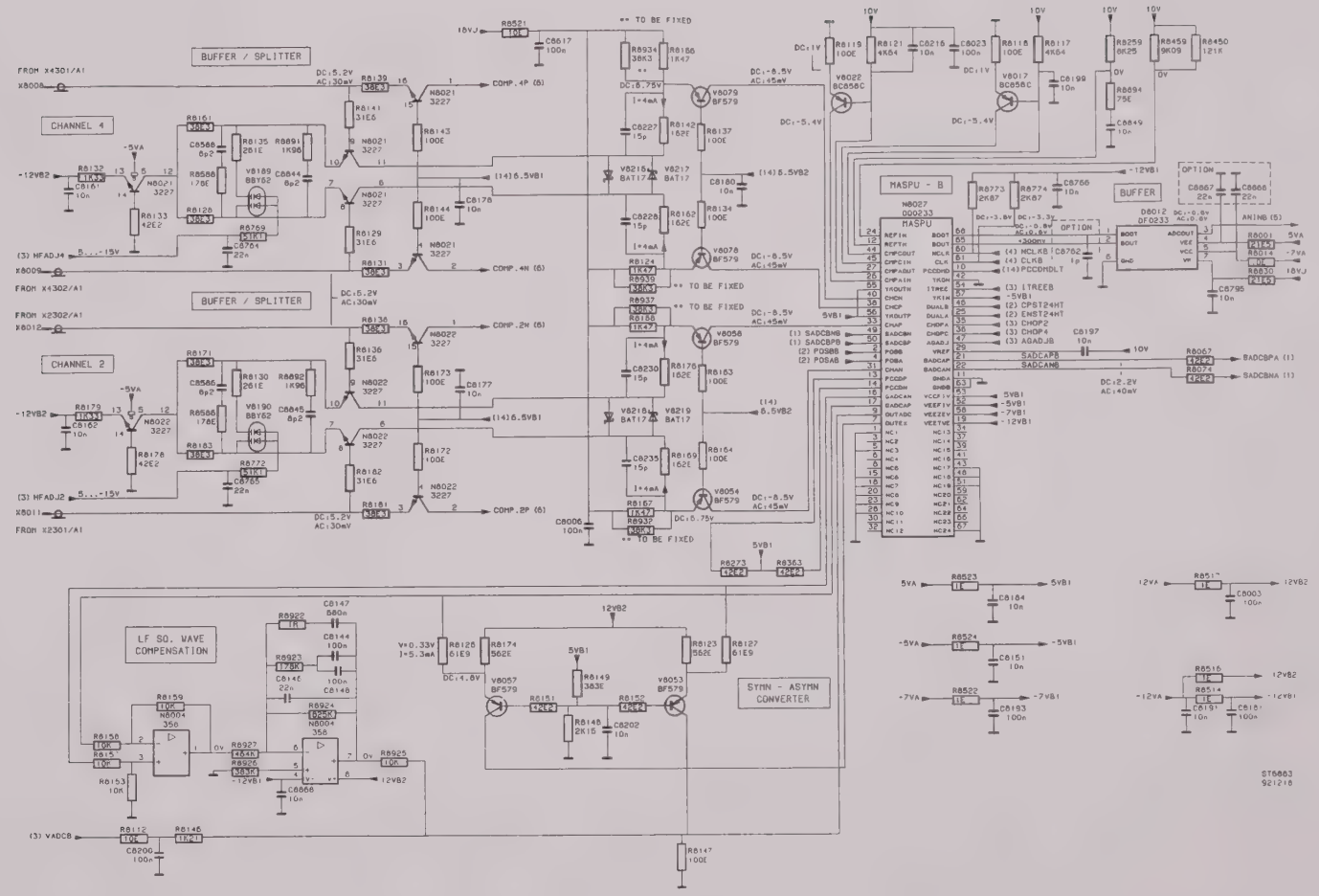
5.8.5 Circuit diagrams



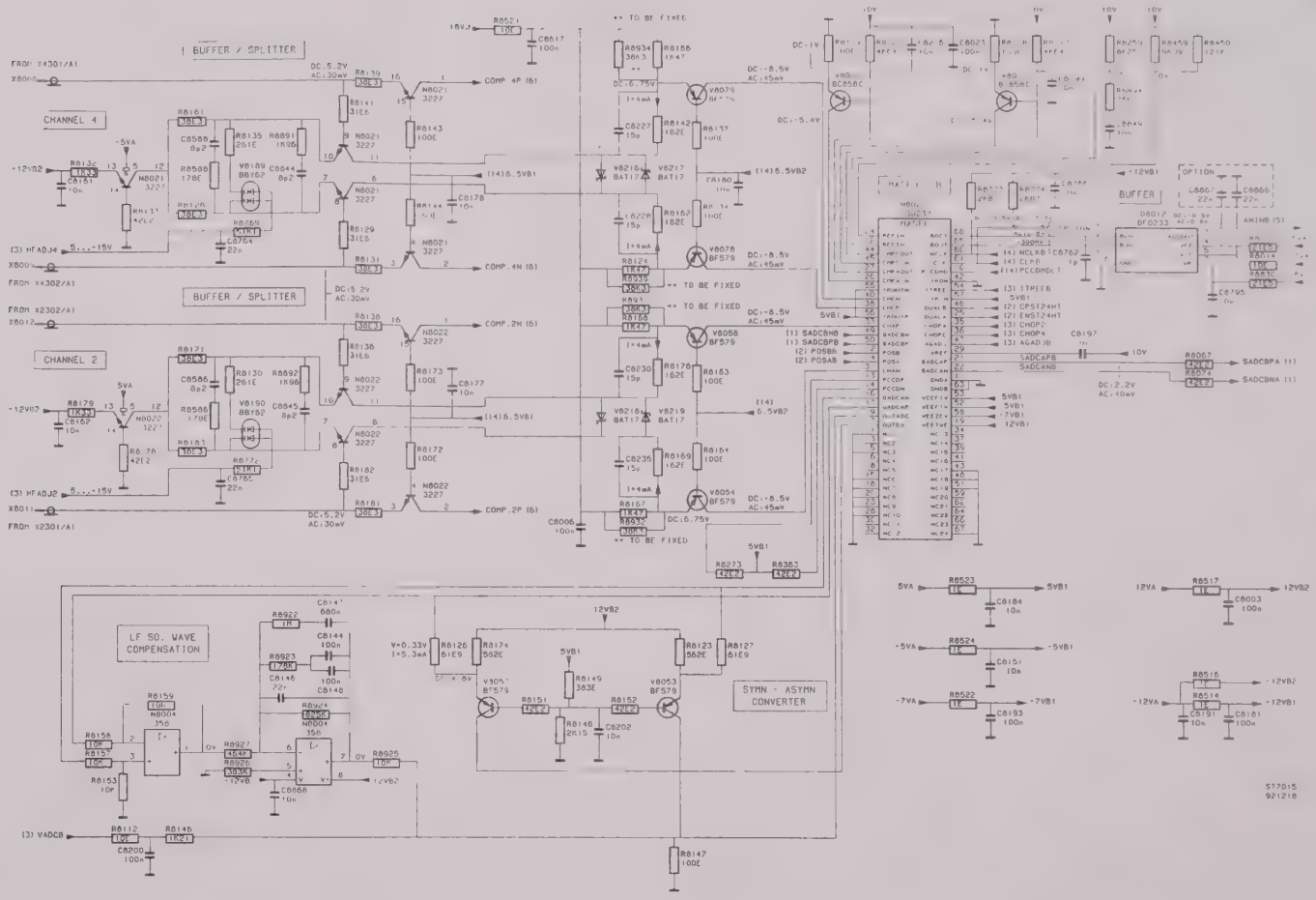
A8 - Diagram 1a; Channel 1 and 3 (200 MHz version)



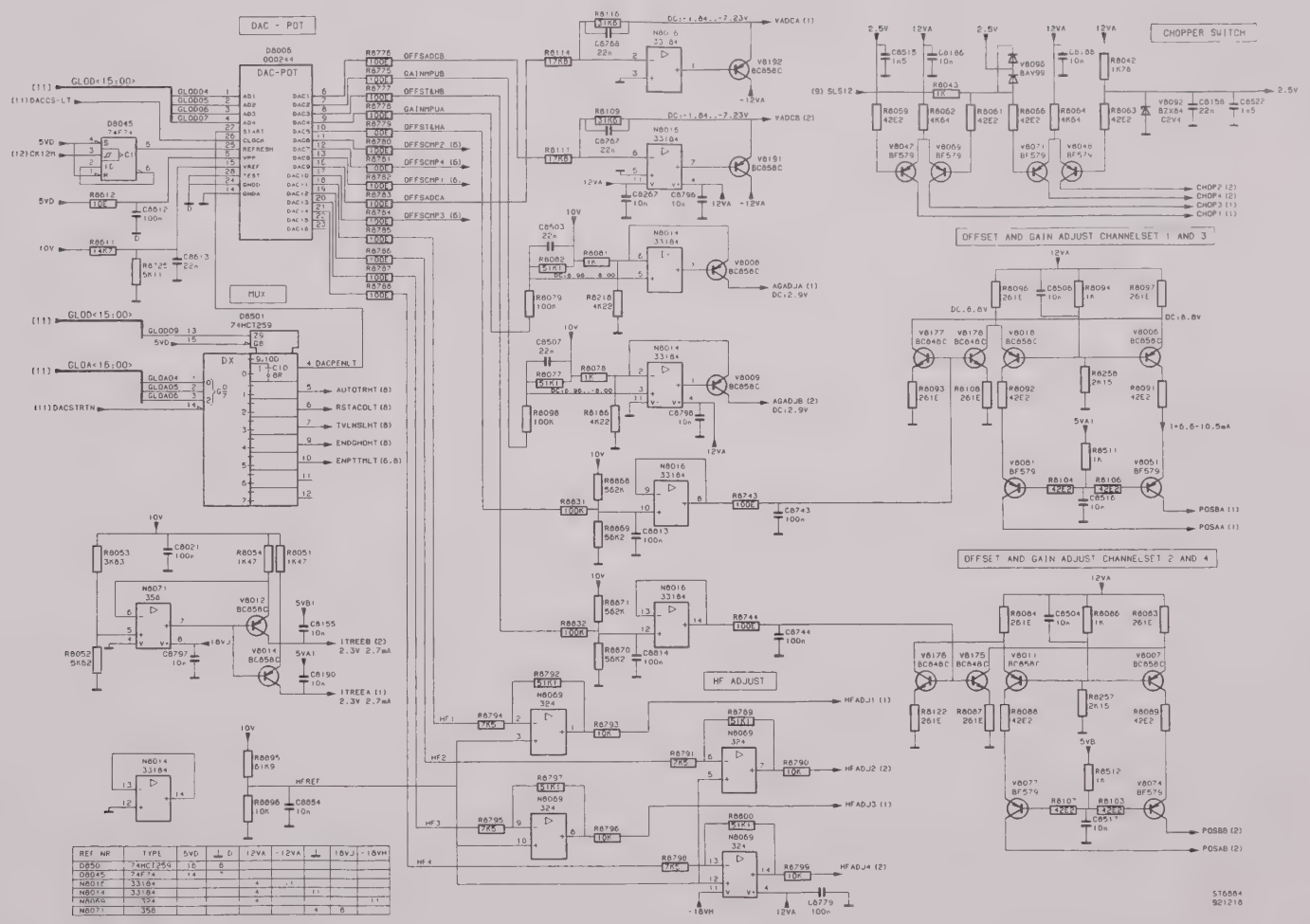
A8 - Diagram 1b; Channel 1 and 3 (100 MHz version)



A8 - Diagram 2a; Channel 2 and 4 (200 MHz version)

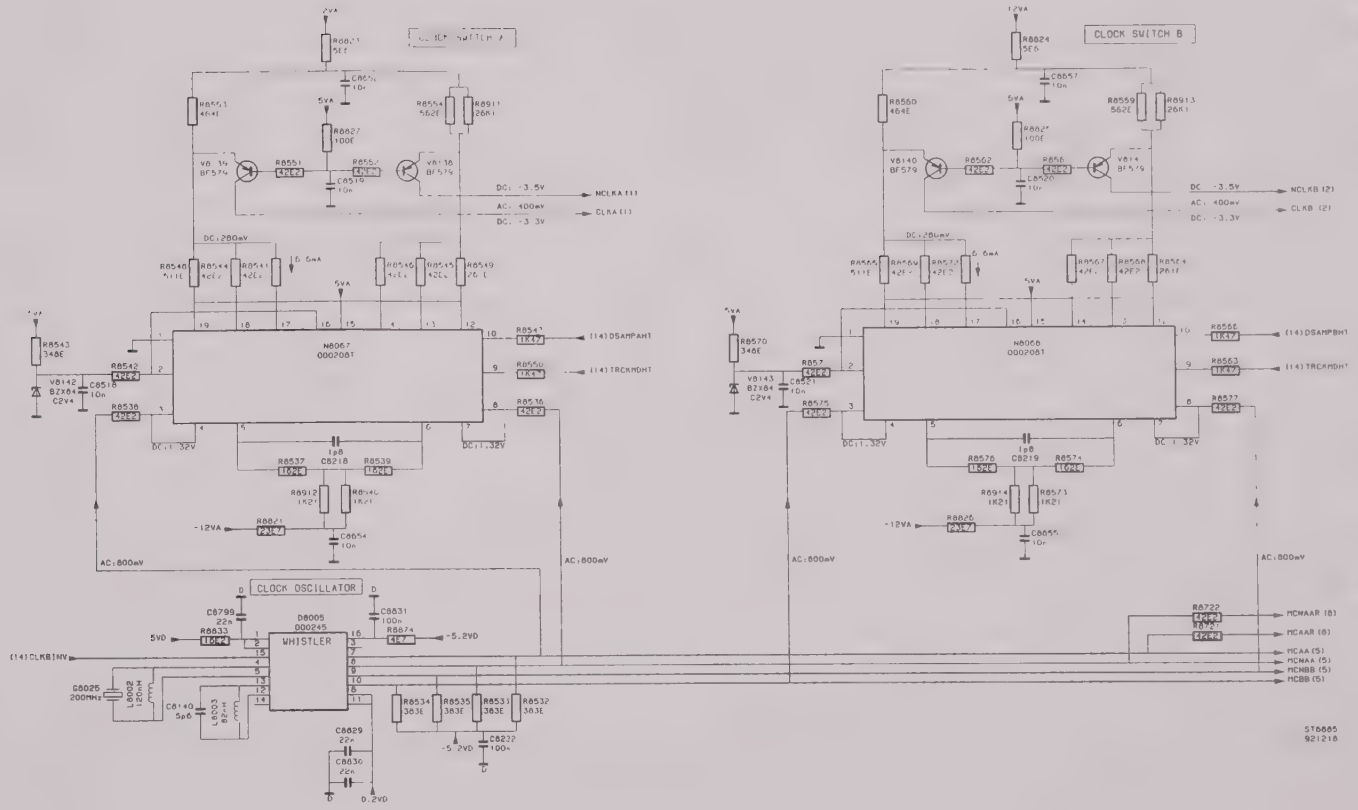


A8 - Diagram 2b; Channel 2 and 4 (100 MHz version)

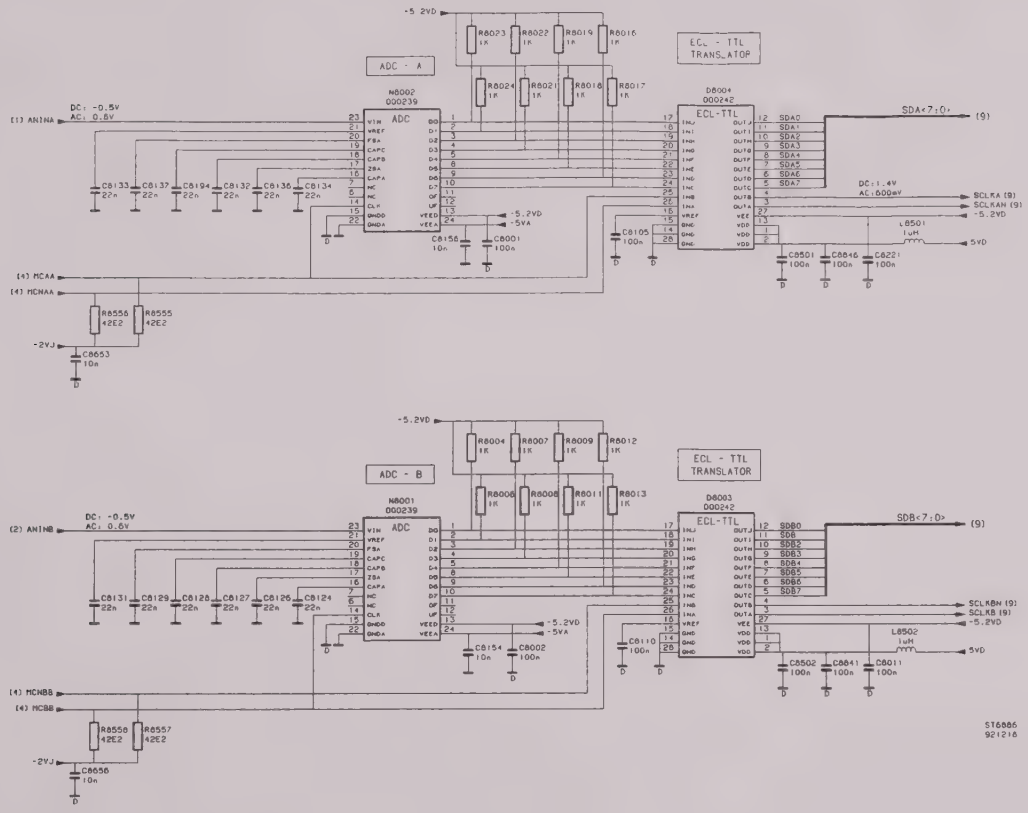


REF NR	TYPE	5VD	⏚ D	12VA	-12VA	⏚	18VJ1 - 18VH
D850	74HCT259	16	8				
D8045	74F74	14	7				
N8015	33184			4	11		
N8014	33184			4	11		
N8069	324			4		11	
N8071	358					4	8

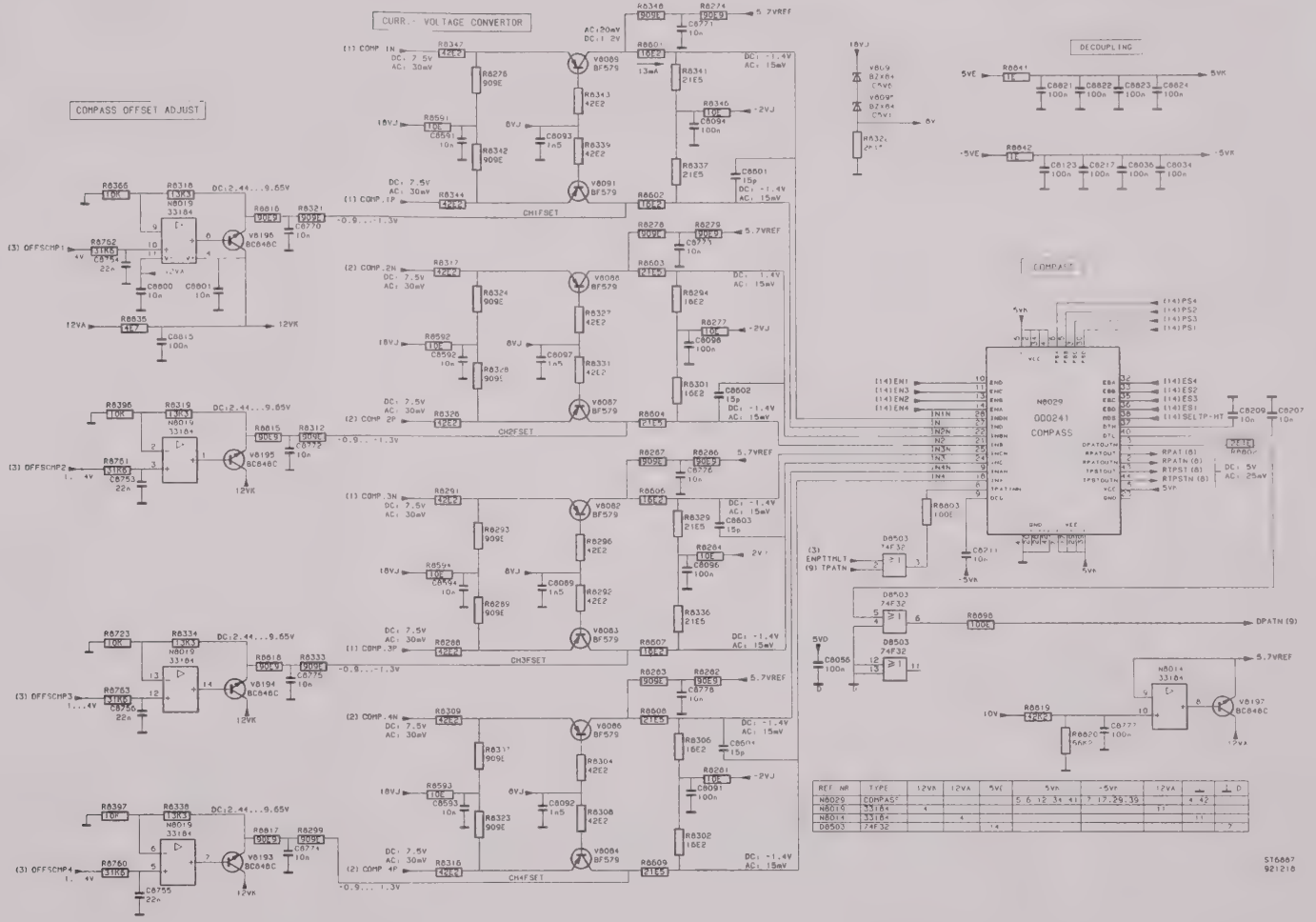
A8 - Diagram 3; Ref. and adj. voltages



A8 - Diagram 4; Clock

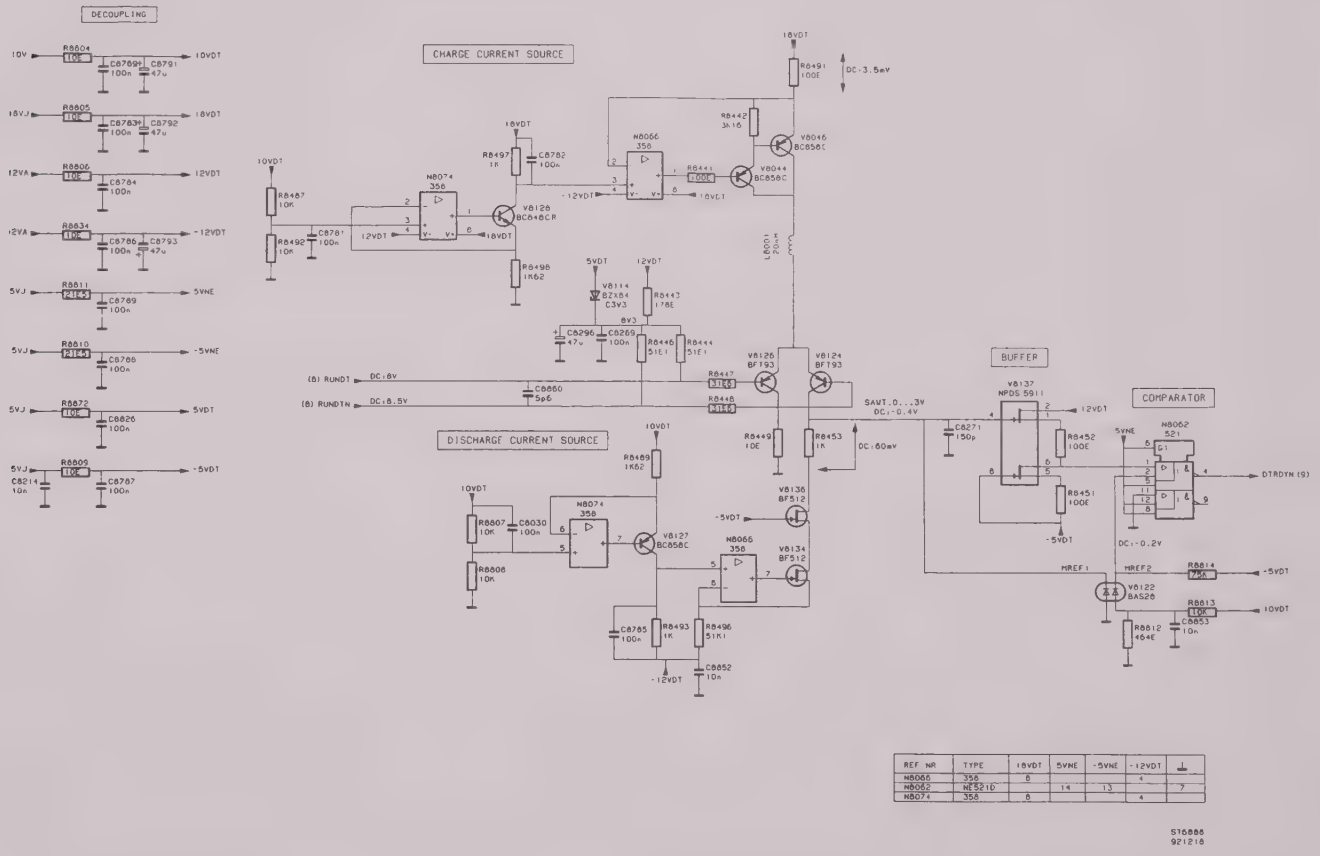


A8 - Diagram 5; ADC and ECL-TTL



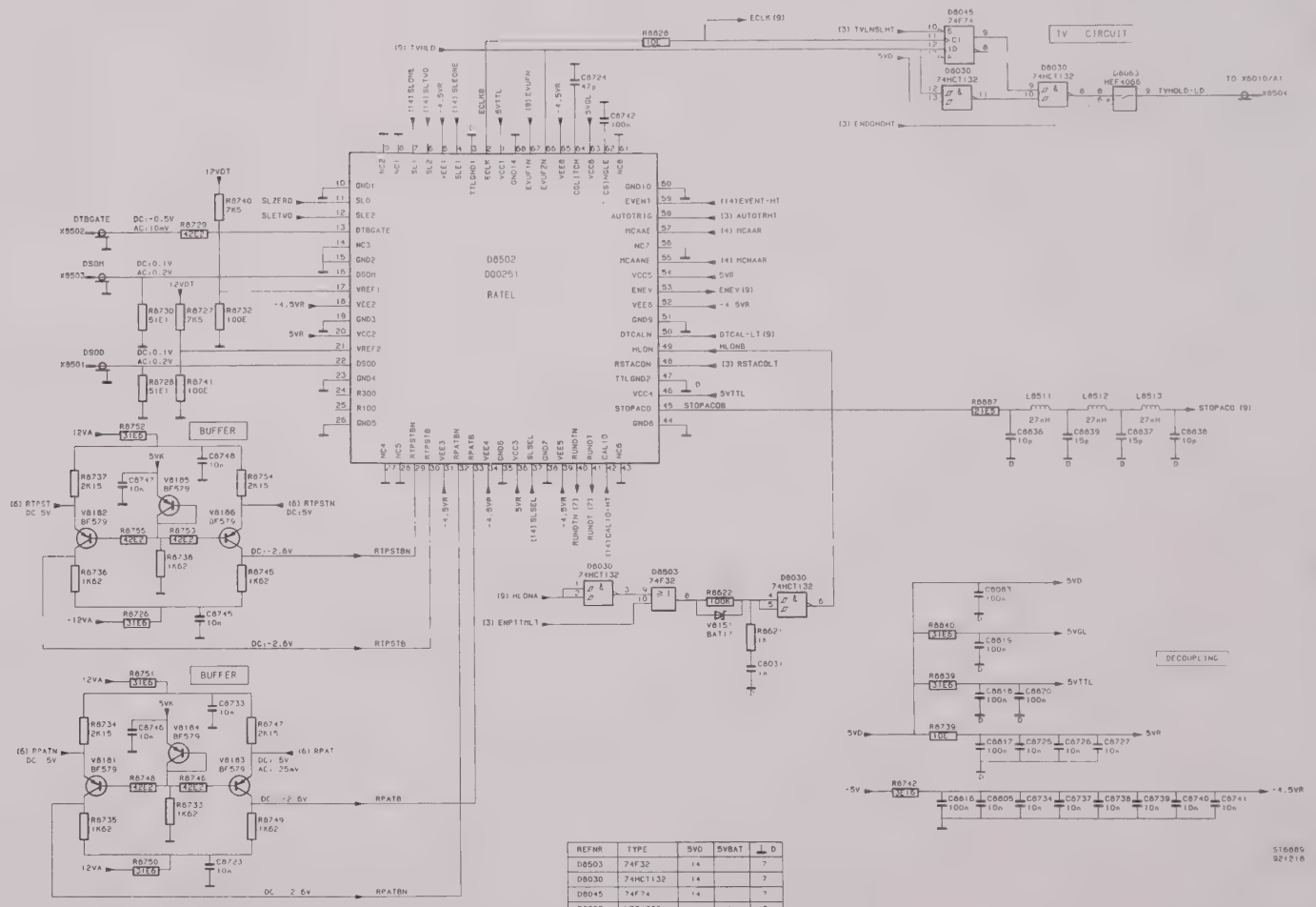
REF NR	TYPE	12VA	12VA	5VE	5VA	-5VE	12VA		D
N8029	COMPASS				5 6 12 3 4 11	7 12 29 39		4 42	
N8019	33184	4					11		
N8014	33184		4					11	
D8503	74F32			14					7

A8 - Diagram 6; COMPASS

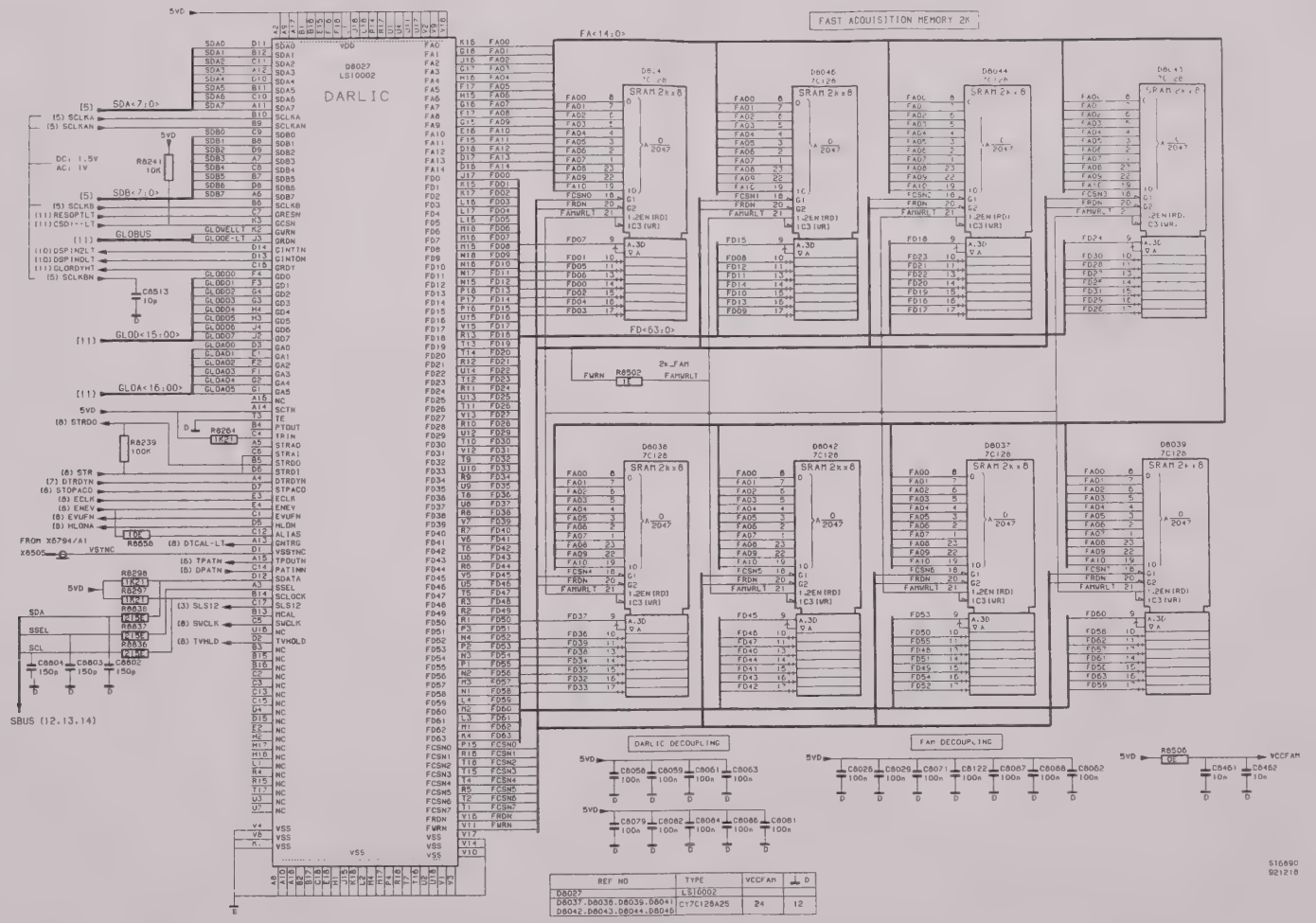


REF NR	TYPE	18VDT	5VNE	-5VNE	-12VDT	⏚
N8066	358	8			4	
N8062	NE521D		14	13		7
N8074	358	8			4	

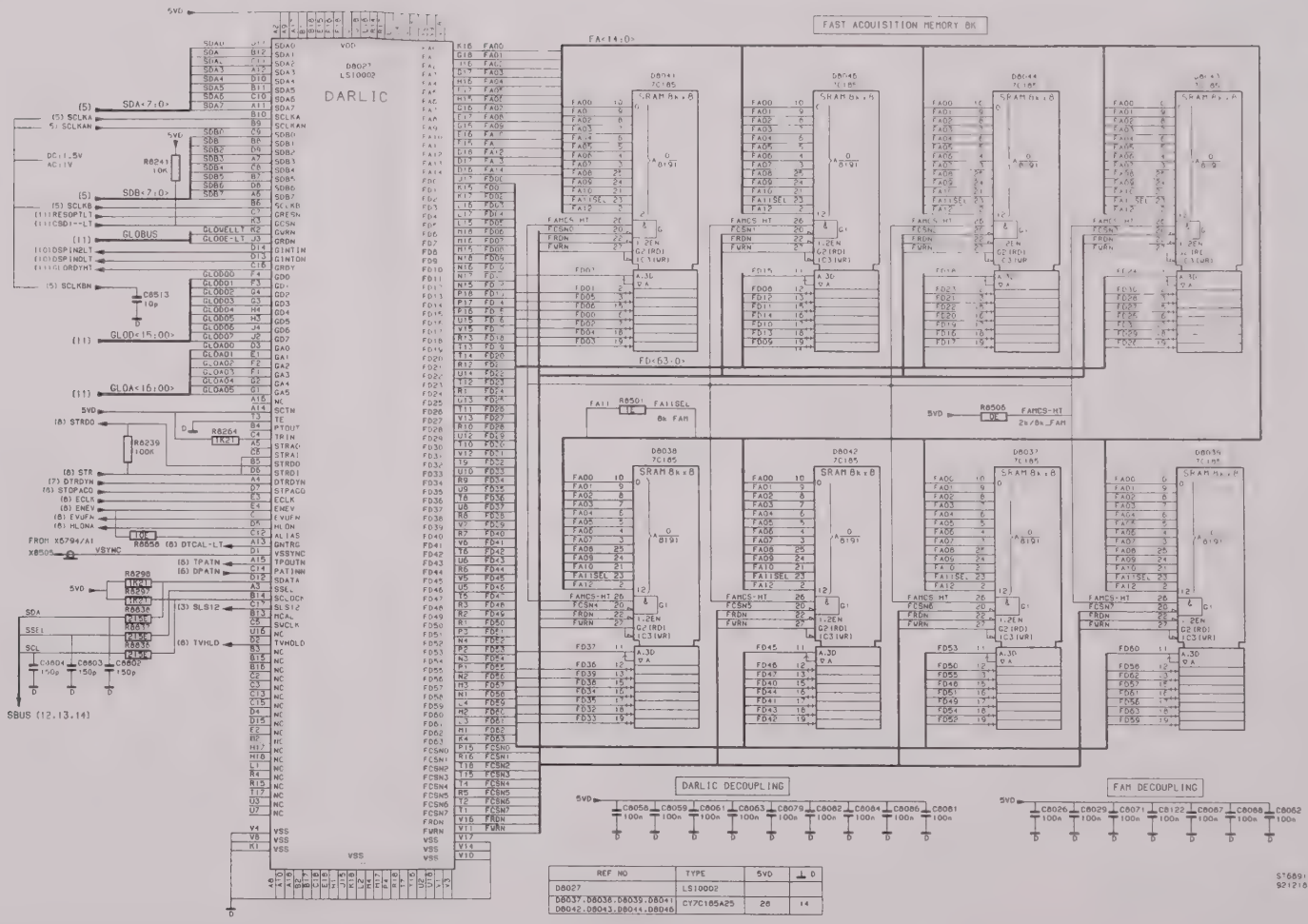
A8 - Diagram 7; Delta T circuit



A8 - Diagram 8; Trigger logic

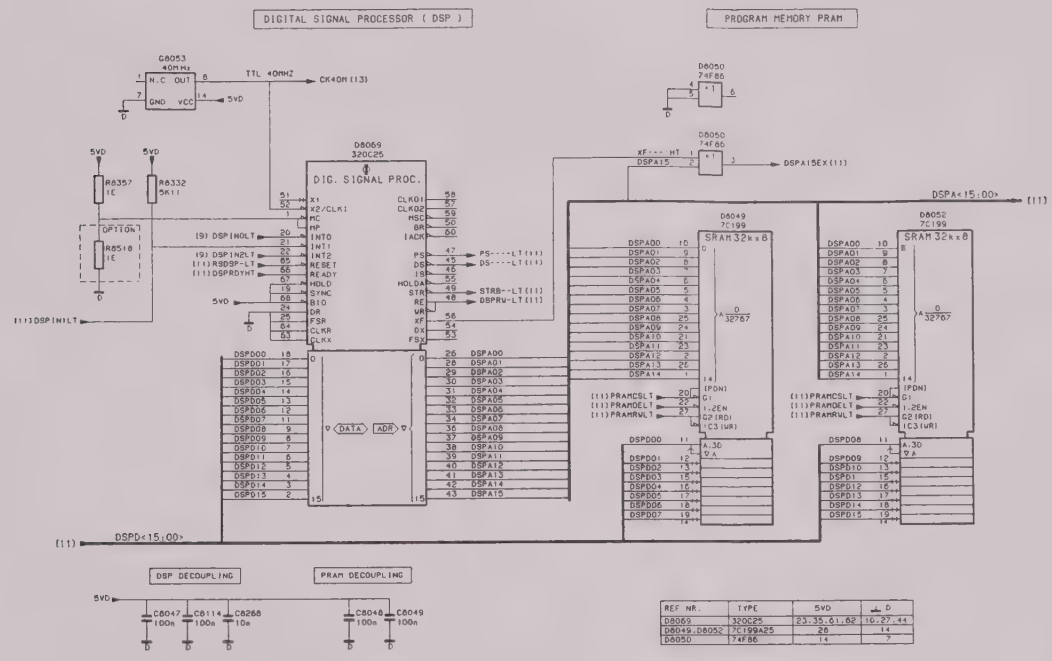


A8 - Diagram 9a; DARLIC and FAM

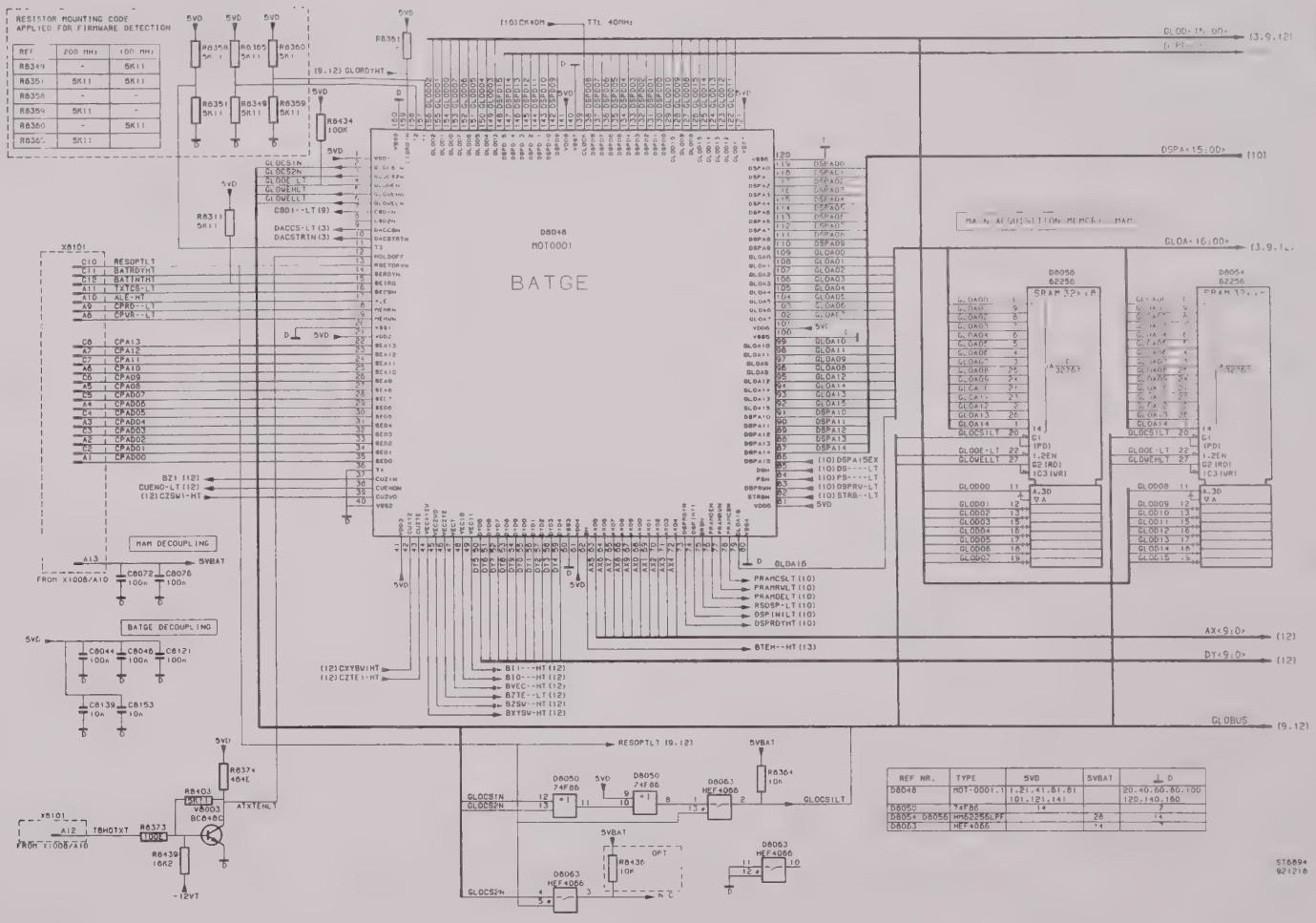


REF NO	TYPE	5VD	⊥ D
D8027	LS10002		
D8037,D8038,D8039,D8041, D8042,D8043,D8044,D8046	CY7C185A25	28	14

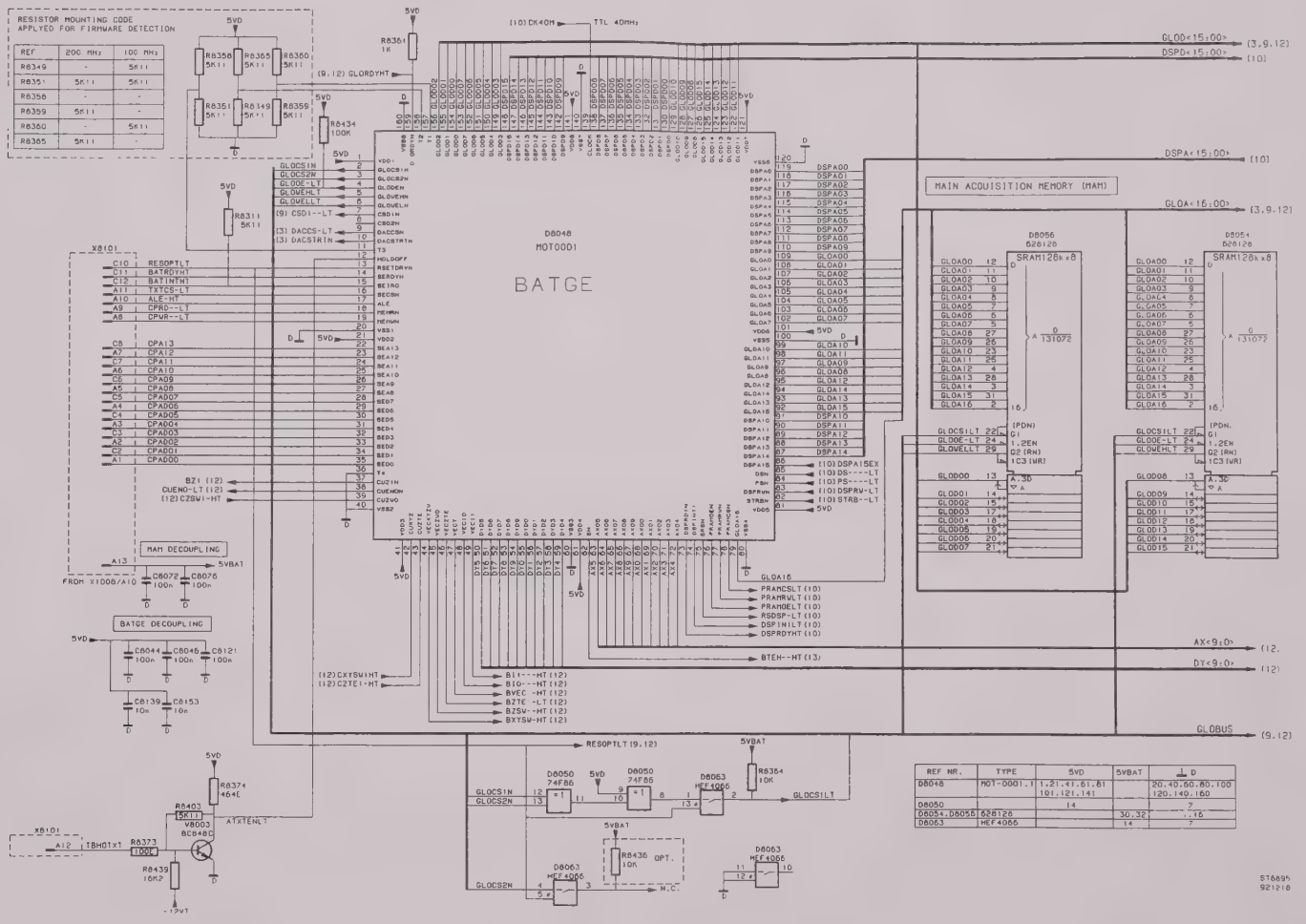
A8 - Diagram 9b; DARLIC and extended FAM



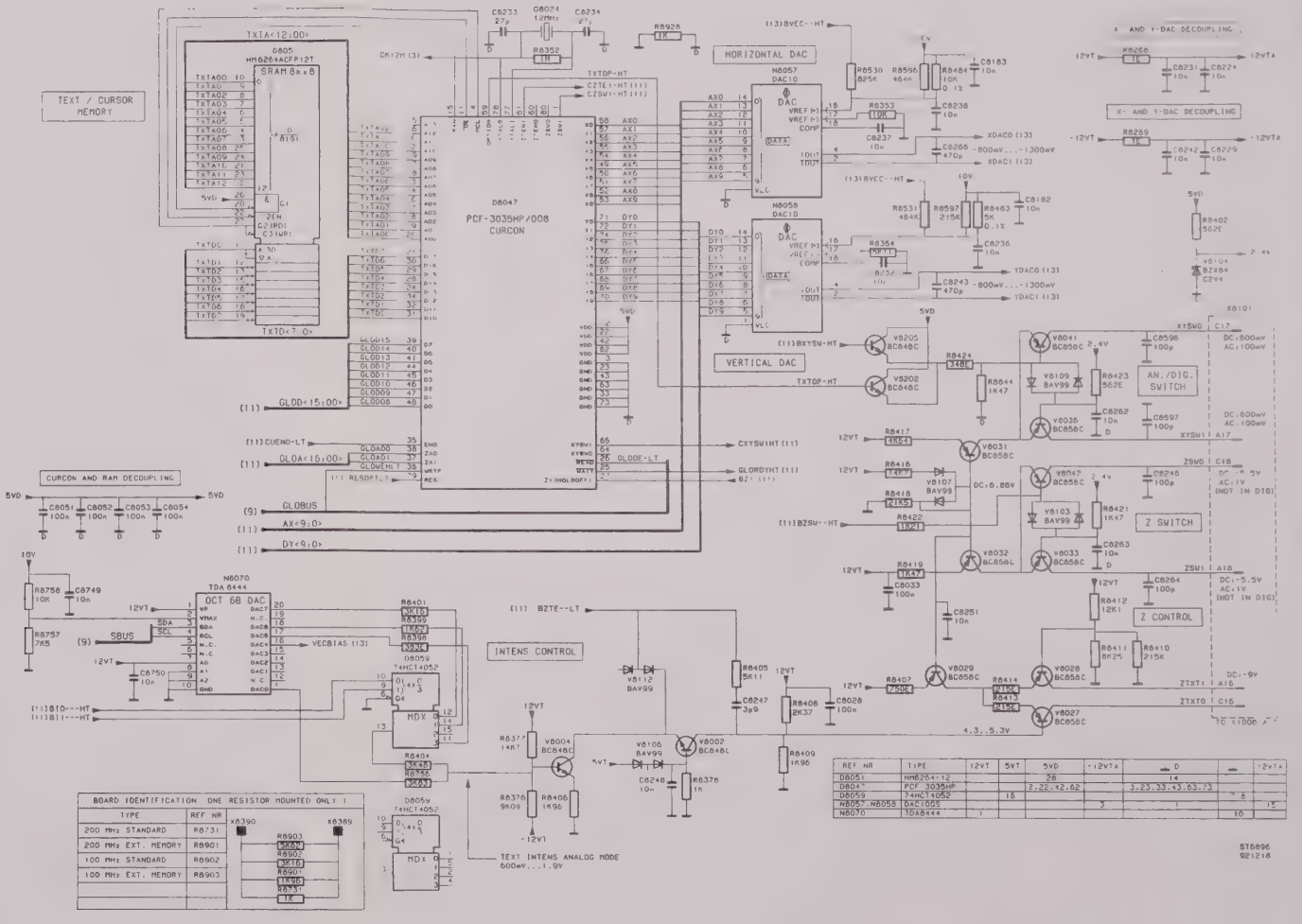
A8 - Diagram 10; Digital Signal Processor



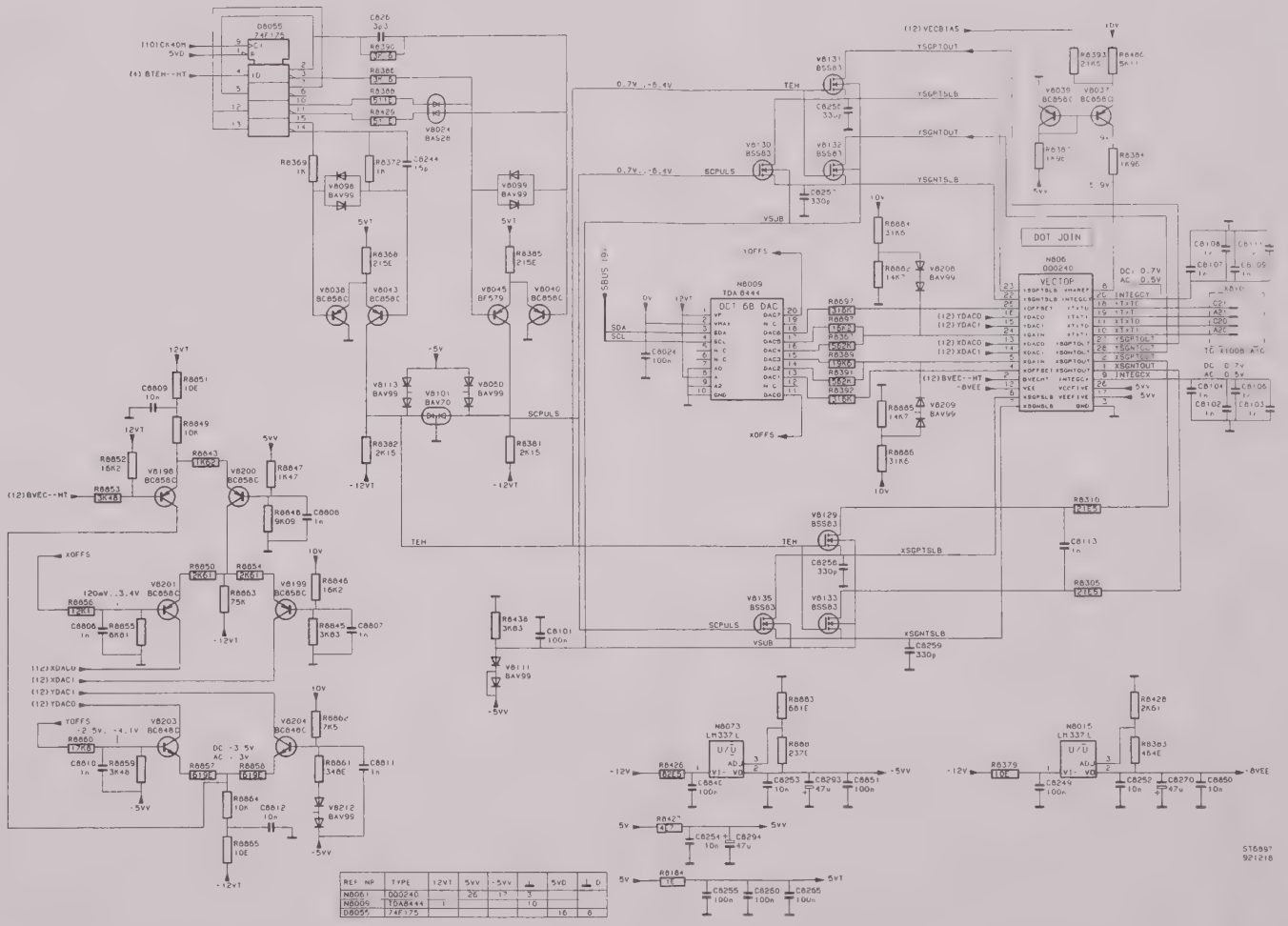
A8 - Diagram 11a; BATGE and MAM



A8 - Diagram 11b; BATGE and extended MAM

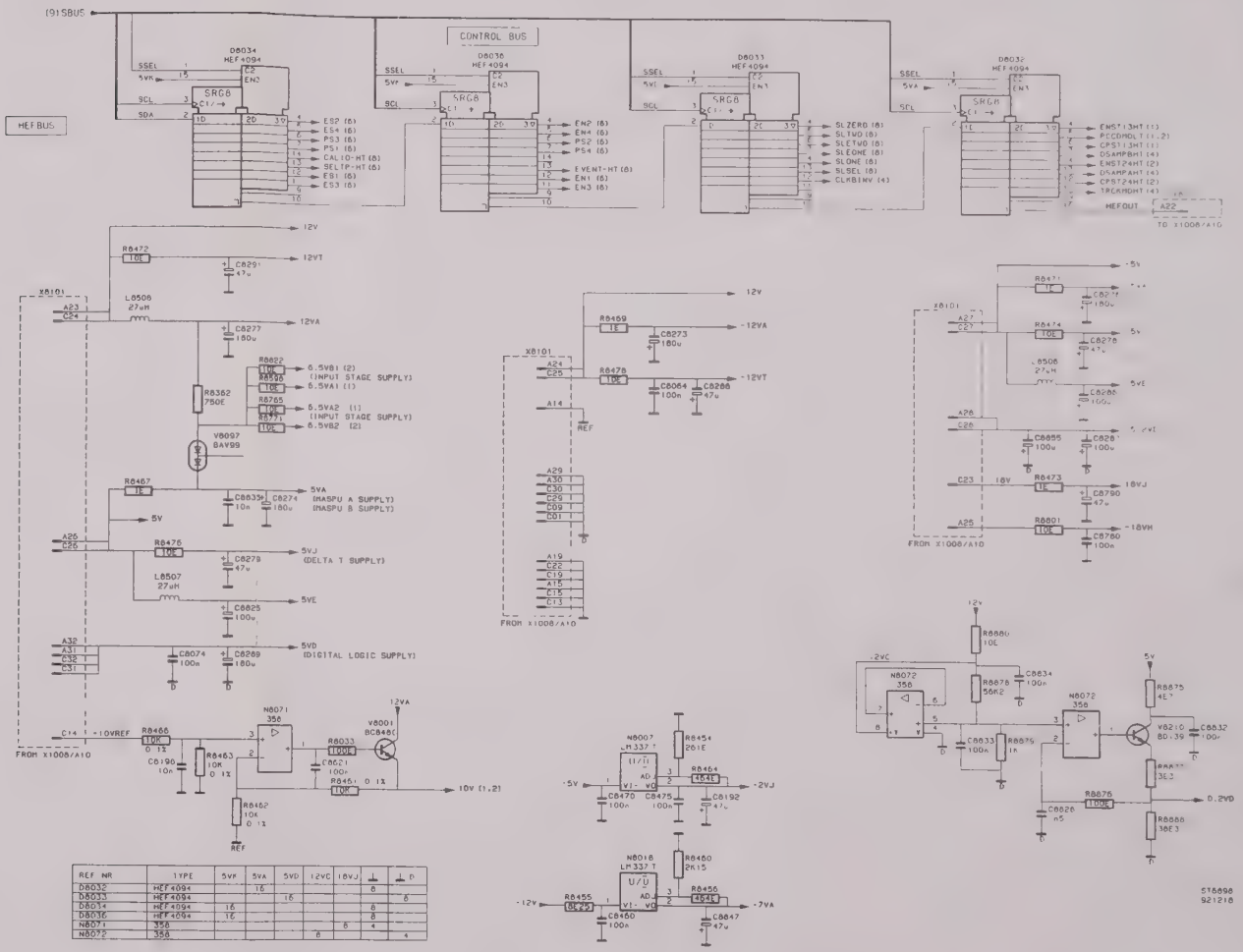


A8 - Diagram 12; CURCON and XYZ Control



REF NR	TYPE	12VT	5VV	-5VV	⏚	5VD	⏚ D
N8061	000240		26	17	3		
N8009	TDA8444	1			10		
D8055	74F175					16	8

A8 - Diagram 13; Display interface



REF NR	TYPE	5VF	5VA	5VD	12VC	18VJ	⊥	⊥ D
D8032	HEF4094		16				8	8
D8033	HEF4094			16			8	8
D8034	HEF4094	16					8	
D8036	HEF4094	16					8	
N8071	358					8	4	
N8072	358				8			4

ST5898
921216

A8 - Diagram 14; Power distribution

5.8.6 Parst list

CAPACITORS

Item	Description		Ordering code
C 8001	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8002	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8003	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8004	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8006	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8007	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8011	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8012	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8021	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8023	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8024	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8026	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8028	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8029	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8030	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8031	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 8033	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8034	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8036	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8044	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8046	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8047	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8048	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8049	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8051	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8052	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8053	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8054	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8056	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8057	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8058	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8059	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8061	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8062	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8063	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8064	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8071	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8072	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8074	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8076	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8079	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8081	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8082	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8083	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8084	CAP.CHIP	63V 10% 100nF	4822 122 33496

Item	Description		Ordering code
C 8086	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8087	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8088	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8089	CAP.CHIP	63V 10% 1.5nF	4822 122 33174
C 8091	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8092	CAP.CHIP	63V 10% 1.5nF	4822 122 33174
C 8093	CAP.CHIP	63V 10% 1.5nF	4822 122 33174
C 8094	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8096	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8097	CAP.CHIP	63V 10% 1.5nF	4822 122 33174
C 8098	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8101	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8102	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 8103	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 8104	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 8105	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8106	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 8107	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 8108	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 8109	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 8110	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8111	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 8113	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 8114	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8121	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8122	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8123	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8124	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8126	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8127	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8128	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8129	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8131	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8132	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8133	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8134	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8136	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8137	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8138	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8139	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8140	CAP.CERAMIC	63V 0.5pF 5.6pF	5322 122 32967
C 8142	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8148	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8149	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8151	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8153	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8154	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8155	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8156	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8158	CAP.CHIP	63V 10% 22nF	5322 122 32654

Item	Description		Ordering code
C 8159	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8161	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8162	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8166	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8169	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8172	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8173	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8175	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8176	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8177	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8178	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8179	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8180	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8181	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8182	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8183	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8184	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8186	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8188	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8189	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8190	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8191	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8192	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 8193	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8194	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8197	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8198	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8199	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8200	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8203	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8206	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8207	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8209	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8211	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8213	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8214	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8215	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8216	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8217	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8218	CAP.CHIP	63V 0.25pF 3.3pF	5322 122 32286
C 8219	CAP.CHIP	63V 0.25pF 3.3pF	5322 122 32286
C 8220	CAP.CHIP	63V 5% 15pF	5322 122 33869
C 8221	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8222	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8223	CAP.CHIP	63V 5% 15pF	5322 122 33869
C 8224	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8225	CAP.CHIP	63V 5% 15pF	5322 122 33869
C 8226	CAP.CHIP	63V 5% 15pF	5322 122 33869
C 8227	CAP.CHIP	63V 5% 15pF	5322 122 33869
C 8228	CAP.CHIP	63V 5% 15pF	5322 122 33869

Item	Description		Ordering code
C 8229	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8230	CAP.CHIP	63V 5% 15pF	5322 122 33869
C 8231	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8232	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8233	CAP.CHIP	63V 5% 27pF	5322 122 31946
C 8234	CAP.CHIP	63V 5% 27pF	5322 122 31946
C 8235	CAP.CHIP	63V 5% 15pF	5322 122 33869
C 8236	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8237	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8238	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8242	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8243	CAP.CHIP	63V 5% 470pF	5322 122 32268
C 8244	CAP.CHIP	63V 5% 15pF	5322 122 33869
C 8246	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 8247	CAP.CHIP	63V 5% 3.9pF	5322 126 10185
C 8248	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8249	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8251	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8252	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8253	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8254	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8255	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8256	CAP.CHIP	63V 5% 330pF	5322 122 31863
C 8257	CAP.CHIP	63V 5% 330pF	5322 122 31863
C 8258	CAP.CHIP	63V 5% 330pF	5322 122 31863
C 8259	CAP.CHIP	63V 5% 330pF	5322 122 31863
C 8260	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8261	CAP.CHIP	63V 0.25pF 3.3pF	5322 122 32286
C 8262	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8263	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8264	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 8265	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8266	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 8267	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8268	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8269	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8270	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 8271	CAP.CHIP	63V 5% 150nF	5322 122 33538
C 8273	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 8274	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 8276	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 8277	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 8278	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 8279	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 8286	CAP.FOIL	10V 20% 100µF	5322 124 41383
C 8287	CAP.FOIL	10V 20% 100µF	5322 124 41383
C 8288	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 8289	CAP.ELECTROLYT.	25V 20% 180µF	5322 124 42228
C 8291	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 8293	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472

Item	Description		Ordering code
C 8294	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 8296	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 8460	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8465	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8470	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8475	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8501	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8502	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8503	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8504	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8506	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8507	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8512	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8513	CAP.CERAMIC	63V 5% 10pF	5322 122 32448
C 8514	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8515	CAP.CHIP	63V 10% 1.5nF	4822 122 33174
C 8516	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8517	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8518	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8519	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8520	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8521	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8522	CAP.CHIP	63V 10% 1.5nF	4822 122 33174
C 8581	CAP.CHIP	63V 10% 8.2pF	5322 122 33244
C 8583	CAP.CHIP	63V 10% 8.2pF	5322 122 33244
C 8586	CAP.CHIP	63V 10% 8.2pF	5322 122 33244
C 8588	CAP.CHIP	63V 10% 8.2pF	5322 122 33244
C 8591	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8592	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8593	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8594	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8596	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 8597	CAP.CHIP	63V 5% 100pF	5322 122 32531
C 8601	CAP.CHIP	63V 5% 15pF	5322 122 33869
C 8602	CAP.CHIP	63V 5% 15pF	5322 122 33869
C 8603	CAP.CHIP	63V 5% 15pF	5322 122 33869
C 8604	CAP.CHIP	63V 5% 15pF	5322 122 33869
C 8611	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8612	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8613	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8617	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8621	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8652	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8653	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8654	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8655	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8656	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8657	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8723	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8724	CAP.CERAMIC	63V 5% 47pF	5322 122 32452

Item	Description		Ordering code
C 8725	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8726	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8727	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8733	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8734	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8737	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8738	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8739	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8740	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8741	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8742	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8743	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8744	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8745	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8746	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8747	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8748	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8749	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8750	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8753	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8754	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8755	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8756	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8758	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8759	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8760	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8764	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8765	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8766	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8767	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8768	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8769	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8770	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8771	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8772	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8773	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8774	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8775	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8776	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8777	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8778	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8779	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8780	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8781	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8782	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8783	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8784	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8785	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8786	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8787	CAP.CHIP	63V 10% 100nF	4822 122 33496

Item	Description		Ordering code
C 8788	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8789	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8790	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 8791	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 8792	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 8793	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 8794	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8795	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8796	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8797	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8798	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8799	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8800	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8801	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8802	CAP.CHIP	63V 5% 150pF	5322 122 33538
C 8803	CAP.CHIP	63V 5% 150pF	5322 122 33538
C 8804	CAP.CHIP	63V 5% 150pF	5322 122 33538
C 8805	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8806	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 8807	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 8808	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 8809	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8810	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 8811	CAP.CHIP	63V 5% 1nF	5322 126 10511
C 8812	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8813	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8814	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8815	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8816	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8817	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8818	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8819	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8820	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8821	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8822	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8823	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8824	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8825	CAP.FOIL	10V 20% 100µF	5322 124 41383
C 8826	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8828	CAP.CHIP	63V 10% 1.5nF	4822 122 33174
C 8829	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8830	CAP.CHIP	63V 10% 22nF	5322 122 32654
C 8831	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8832	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8833	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8834	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8835	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8836	CAP.CERAMIC	63V 5% 10pF	5322 122 32448
C 8837	CAP.CHIP	63V 5% 15pF	5322 122 33869
C 8838	CAP.CERAMIC	63V 5% 10pF	5322 122 32448

Item	Description		Ordering code
C 8839	CAP.CHIP	63V 5% 15pF	5322 122 33869
C 8840	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8841	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8846	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8847	CAP.ELECTROLYT.	25V 20% 47µF	5322 121 10472
C 8848	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8849	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8850	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8851	CAP.CHIP	63V 10% 100nF	4822 122 33496
C 8852	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8853	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8854	CAP.CHIP	63V 10% 10nF	5322 122 34098
C 8855	CAP.FOIL	10V 20% 100µF	5322 124 41383
C 8860	CAP.CERAMIC	63V 0.5pF 5.6pF	5322 122 32967
C 8861	CAP.CHIP	63V 10% 220nF	4822 122 32916
C 8862	CAP.CHIP	63V 10% 220nF	4822 122 32916

INTEGRATED CIRCUITS

D 8003	INTEGR.CIRCUIT	OQ0242T ETT	5322 209 12513
D 8004	INTEGR.CIRCUIT	OQ0242T ETT	5322 209 12513
D 8005	INTEGR.CIRCUIT	OQ0245T XOSC	5322 209 12514
D 8006	INTEGR.CIRCUIT	OQ0244 DACPOT	5322 209 12468
D 8012	INTEGR.CIRCUIT	OQ0244 DACPOT	5322 209 12468
D 8013	INTEGR.CIRCUIT	OQ0244 DACPOT	5322 209 12468
D 8027	INTEGR.CIRCUIT	LSI0002 DARLIC	5322 209 12516
D 8032	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
D 8033	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
D 8034	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
D 8036	INTEGR.CIRCUIT	HEF4094BT PEL	5322 209 11306
D 8037	INTEGR.CIRCUIT	Y7C128A25SC CYP	4822 209 31099
D 8038	INTEGR.CIRCUIT	Y7C128A25SC CYP	4822 209 31099
D 8039	INTEGR.CIRCUIT	Y7C128A25SC CYP	4822 209 31099
D 8041	INTEGR.CIRCUIT	Y7C128A25SC CYP	4822 209 31099
D 8042	INTEGR.CIRCUIT	Y7C128A25SC CYP	4822 209 31099
D 8043	INTEGR.CIRCUIT	Y7C128A25SC CYP	4822 209 31099
D 8044	INTEGR.CIRCUIT	Y7C128A25SC CYP	4822 209 31099
D 8045	INTEGR.CIRCUIT	N74F74D PEL	5322 209 61004
D 8046	INTEGR.CIRCUIT	Y7C128A25SC CYP	4822 209 31099
D 8047	INTEGR.CIRCUIT	CURSOR CONTROL 2	5322 209 30217
D 8048	INTEGR.CIRCUIT	MOT0001 BATGE	5322 209 12515
D 8049	INTEGR.CIRCUIT	32K PROM 25SC	5322 209 31149
D 8050	INTEGR.CIRCUIT	N74F86D PEL	5322 209 60265
D 8051	INTEGR.CIRCUIT	264ALFP-12T HIT	5322 209 30265
D 8052	INTEGR.CIRCUIT	32K PROM 25SC	5322 209 31149
D 8054	INTEGR.CIRCUIT	56LFP-10TZU HIT	5322 209 30228
D 8055	INTEGR.CIRCUIT	N74F175D PEL	5322 209 61452
D 8056	INTEGR.CIRCUIT	56LFP-10TZU HIT	5322 209 30228
D 8059	INTEGR.CIRCUIT	C74HCT4052T PEL	5322 209 61132

Item	Description		Ordering code
D 8063	INTEGR.CIRCUIT	HEF4066BT PEL	5322 209 14542
D 8069	INTEGR.CIRCUIT	MS320C25FNL T.I	5322 209 62743
D 8501	INTEGR.CIRCUIT	PC74HCT259T PEL	4822 209 30086
N 8001	INTEGR.CIRCUIT	OQ0239T ADC	5322 209 12509
N 8007	INTEGR.CIRCUIT	LM337T N.S	5322 209 81236
N 8009	INTEGR.CIRCUIT	DA8444AT/N2 PEL	5322 209 30233
N 8015	INTEGR.CIRCUIT	LM337T N.S	5322 209 81236
N 8018	INTEGR.CIRCUIT	LM337T N.S	5322 209 81236
N 8021	INTEGR.CIRCUIT	SL3227MPT PLS	5322 209 60194
N 8022	INTEGR.CIRCUIT	SL3227MPT PLS	5322 209 60194
N 8023	INTEGR.CIRCUIT	SL3227MPT PLS	5322 209 60194
N 8024	INTEGR.CIRCUIT	SL3227MPT PLS	5322 209 60194
N 8026	INTEGR.CIRCUIT	OQ0233WP MASPU	5322 209 12508
N 8029	INTEGR.CIRCUIT	OQ0241 COMPASS	5322 209 12512
N 8057	INTEGR.CIRCUIT	DAC10GS PMI	5322 209 12469
N 8058	INTEGR.CIRCUIT	DAC10GS PMI	5322 209 12469
N 8061	INTEGR.CIRCUIT	OQ0240P VECTOR	5322 209 12511
N 8062	INTEGR.CIRCUIT	NE521D PEL	5322 209 60297
N 8066	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 8069	INTEGR.CIRCUIT	LM324M NSC	5322 209 61473
N 8070	INTEGR.CIRCUIT	DA8444AT/N2 PEL	5322 209 30233
N 8071	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 8072	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
N 8073	INTEGR.CIRCUIT	LM337LZ NSC	5322 209 83228
N 8074	INTEGR.CIRCUIT	LM358M NSC	4822 209 60175
MISCELLANEOUS			
G 8024	CERAM FILTER	12MHZ KYO	5322 242 71444
G 8053	CRYSTAL	RQ-0-50-40M S.R	5322 242 72575
COILS			
L 8001	COIL	.12UH 5% TDK	5322 157 63916
L 8002	COIL	.12UH 5% TDK	5322 157 63916
L 8003	COIL	082UH 5% TDK	5322 157 63382
L 8501	COIL	1UH 5% TDK	5322 157 63648
L 8502	COIL	1UH 5% TDK	5322 157 63648
L 8506	COIL	27UH	4822 158 10551
L 8507	COIL	27UH	4822 158 10551
L 8508	COIL	27UH	4822 158 10551
RESISTORS			
R 8001	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8002	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8003	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8004	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8006	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8007	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8008	RES.CHIP	RC-02H 1% 1K	4822 051 51002

Item	Description		Ordering code
R 8009	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8011	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8012	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8013	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8014	RES.CHIP	RC-02H 1% 10E	2120 108 90919
R 8016	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8017	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8018	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8019	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8021	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8022	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8023	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8024	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8033	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8042	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 8043	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8051	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8052	RES.CHIP	RC-02H 1% 5K62	4822 051 55622
R 8053	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 8054	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8057	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8058	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8059	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8061	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8062	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 8063	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8064	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 8066	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8067	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8074	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8077	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 8078	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8079	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 8081	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8082	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 8083	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 8084	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 8086	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8087	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 8088	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8089	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8091	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8092	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8093	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 8094	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8096	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 8097	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 8098	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 8103	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8104	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887

Item	Description		Ordering code
R 8106	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8107	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8108	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 8109	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 8111	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 8112	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8114	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 8116	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 8117	RES.CHIP	RC-02H 1% 8K25	4822 051 58252
R 8118	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8119	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8121	RES.CHIP	RC-02H 1% 8K25	4822 051 58252
R 8122	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 8124	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8126	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 8127	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 8129	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8130	RES.CHIP	RC-02H 1% 196E	4822 051 51961
R 8132	RES.CHIP	RC-02H 1% 1K33	4822 051 51332
R 8133	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8134	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8135	RES.CHIP	RC-02H 1% 196E	4822 051 51961
R 8136	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8137	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8141	RES.CHIP	RMC1/8 1% 215E	4822 051 52151
R 8142	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 8143	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8144	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8146	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 8147	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8148	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 8149	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 8151	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8152	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8153	RES.CHIP	RC-02H 1% 562E	4822 051 55621
R 8159	RES.CHIP	RC-02H 1% 562E	4822 051 55621
R 8162	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 8163	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8164	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8166	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8167	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8168	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8169	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 8172	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8173	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8176	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 8178	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8179	RES.CHIP	RC-02H 1% 1K33	4822 051 51332
R 8182	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8184	RES.METAL FILM	MRS25 1% 1E	4822 050 21008

Item	Description		Ordering code
R 8185	RES.CHIP	RC-02H 1% 46K4	4822 051 54643
R 8186	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 8188	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8189	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 8191	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 8193	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8196	RES.CHIP	RC-02H 1% 1K33	4822 051 51332
R 8197	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8198	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8199	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8201	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8204	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8205	RES.CHIP	RC-02H 1% 196E	4822 051 51961
R 8206	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 8207	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8208	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8210	RES.CHIP	RC-02H 1% 196E	4822 051 51961
R 8211	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 8212	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8214	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8216	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8218	RES.CHIP	RC-02H 1% 4K22	4822 051 54222
R 8219	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8221	RES.CHIP	RC-02H 1% 1K33	4822 051 51332
R 8223	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8226	RES.CHIP	RC-02H 1% 8K25	4822 051 58252
R 8227	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8228	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8229	RES.CHIP	RC-02H 1% 8K25	4822 051 58252
R 8231	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 8232	RES.CHIP	RC-02H 1% 110E	4822 051 51101
R 8233	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 8234	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 8236	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8237	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8238	RES.CHIP	RC-02H 1% 562E	4822 051 55621
R 8239	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 8244	RES.CHIP	RC-02H 1% 562E	4822 051 55621
R 8246	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8247	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8248	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8252	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8253	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 8254	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 8256	RES.CHIP	RC-02H 1% 8K25	4822 051 58252
R 8257	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 8258	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 8259	RES.CHIP	RC-02H 1% 8K25	4822 051 58252
R 8261	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8264	RES.CHIP	RC-02H 1% 1K21	4822 051 51212

Item	Description		Ordering code
R 8268	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8269	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8271	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8272	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8273	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8274	RES.CHIP	RMC1/8 1% 90E9	5322 111 92018
R 8276	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 8277	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8278	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 8279	RES.CHIP	RMC1/8 1% 90E9	5322 111 92018
R 8281	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8282	RES.CHIP	RMC1/8 1% 90E9	5322 111 92018
R 8283	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 8284	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8286	RES.CHIP	RMC1/8 1% 90E9	5322 111 92018
R 8287	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 8288	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8289	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 8291	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8292	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8293	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 8294	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8296	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8297	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 8298	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 8299	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 8301	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8302	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8304	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8305	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8306	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8307	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 8308	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8309	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8310	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8311	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8312	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 8316	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8317	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8318	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 8319	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 8321	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 8322	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 8323	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 8324	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 8326	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8327	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8328	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 8329	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8331	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887

Item	Description		Ordering code
R 8332	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8333	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 8334	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 8336	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8337	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8338	RES.CHIP	RC-02H 1% 13K3	4822 051 51333
R 8339	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8341	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8342	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 8343	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8344	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8346	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8347	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8348	RES.CHIP	RC-02H 1% 909E	4822 051 59091
R 8349	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8351	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8352	RES.CHIP	RC-02H 1% 1M	4822 051 51005
R 8353	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8354	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8357	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8359	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8361	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8362	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 8363	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8364	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8366	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8367	RES.CHIP	RC-02H 1% 562K	4822 051 55624
R 8368	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 8369	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8372	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8373	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8374	RES.CHIP	RC-02H 1% 464E	4822 051 54641
R 8376	RES.CHIP	RC-02H 1% 9K09	4822 051 59092
R 8377	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 8378	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8379	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8381	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 8382	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 8383	RES.CHIP	RC-02H 1% 464E	4822 051 54641
R 8384	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 8385	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 8386	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 8387	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 8388	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 8389	RES.CHIP	RC-02H 1% 19K6	4822 051 51963
R 8390	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 8391	RES.CHIP	RC-02H 1% 562K	4822 051 55624
R 8392	RES.CHIP	RC-02H 1% 316K	4822 051 53164
R 8393	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 8396	RES.CHIP	RC-02H 1% 10K	4822 051 51003

Item	Description		Ordering code
R 8397	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8398	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 8399	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 8401	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 8402	RES.CHIP	RC-02H 1% 562E	4822 051 55621
R 8403	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8404	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 8405	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8406	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 8407	RES.CHIP	RC-02H 1% 750E	4822 051 57501
R 8408	RES.CHIP	RC-02H 1% 2K37	4822 051 52372
R 8409	RES.CHIP	RC-02H 1% 1K96	4822 051 51962
R 8410	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 8411	RES.CHIP	RC-02H 1% 8K25	4822 051 58252
R 8412	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 8413	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 8414	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 8416	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 8417	RES.CHIP	RC-02H 1% 4K64	4822 051 54642
R 8418	RES.CHIP	RC-02H 1% 21K5	4822 051 52153
R 8419	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8421	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8422	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 8423	RES.CHIP	RC-02H 1% 562E	4822 051 55621
R 8424	RES.CHIP	RC-02H 1% 348E	4822 051 53481
R 8426	RES.CHIP	RMC1/8 1% 82E5	5322 111 92017
R 8427	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 8428	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 8429	RES.CHIP	RC-02H 1% 511E	4822 051 55111
R 8434	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 8438	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 8439	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 8441	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8442	RES.CHIP	RC-02H 1% 3K16	4822 051 53162
R 8443	RES.CHIP	RC-02H 1% 178E	4822 051 51781
R 8444	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 8446	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 8447	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 8448	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 8449	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8450	RES.CHIP	RC-02H 1% 121K	4822 051 51214
R 8451	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8452	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8453	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8454	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 8455	RES.METAL FILM	MRS25 1% 8E25	4822 050 28258
R 8456	RES.CHIP	RC-02H 1% 464E	4822 051 54641
R 8458	RES.CHIP	RC-02H 1% 9K09	4822 051 59092
R 8459	RES.CHIP	RC-02H 1% 9K09	4822 051 59092
R 8460	RES.CHIP	RC-02H 1% 2K15	4822 051 52152

Item	Description		Ordering code
R 8461	RES.METAL FILM	1/4W 0.1% 10K	5322 116 82868
R 8462	RES.METAL FILM	1/4W 0.1% 10K	5322 116 82868
R 8463	RES.METAL FILM	1/4W 0.1% 10K	5322 116 82868
R 8464	RES.CHIP	RC-02H 1% 464E	4822 051 54641
R 8465	RES.CHIP	RC-02H 1% 121K	4822 051 51214
R 8466	RES.METAL FILM	1/4W 0.1% 10K	5322 116 82868
R 8467	RES.METAL FILM	MRS25 1% 1E	4822 050 21008
R 8469	RES.METAL FILM	MRS25 1% 1E	4822 050 21008
R 8471	RES.METAL FILM	MRS25 1% 1E	4822 050 21008
R 8472	RES.METAL FILM	MRS25 1% 10E	4822 050 21009
R 8473	RES.METAL FILM	MRS25 1% 1E	4822 050 21008
R 8474	RES.METAL FILM	MRS25 1% 10E	4822 050 21009
R 8476	RES.METAL FILM	MRS25 1% 10E	4822 050 21009
R 8478	RES.METAL FILM	MRS25 1% 10E	4822 050 21009
R 8483	RES.METAL FILM	1/4W 0.1% 5K	5322 116 80369
R 8484	RES.METAL FILM	1/4W 0.1% 10K	5322 116 82868
R 8486	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8487	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8489	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 8491	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8492	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8493	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8496	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 8497	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8498	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 8503	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8508	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8509	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8511	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8512	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8514	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8516	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8517	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8519	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8521	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8522	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8523	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8524	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8526	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8527	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8528	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8530	RES.CHIP	RC-02H 1% 825K	4822 051 58254
R 8531	RES.CHIP	RC-02H 1% 46K4K	4822 051 54643
R 8532	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 8533	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 8534	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 8535	RES.CHIP	RC-02H 1% 383E	4822 051 53831
R 8536	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8537	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 8538	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887

Item	Description		Ordering code
R 8539	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 8540	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 8541	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8542	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8543	RES.CHIP	RC-02H 1% 348E	4822 051 53481
R 8544	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8545	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8546	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8547	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8548	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 8549	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 8550	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8551	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8552	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8553	RES.CHIP	RC-02H 1% 1K1	4822 051 51102
R 8554	RES.CHIP	RC-02H 1% 1K1	4822 051 51102
R 8555	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8556	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8557	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8558	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8559	RES.CHIP	RC-02H 1% 1K1	4822 051 51102
R 8560	RES.CHIP	RC-02H 1% 1K1	4822 051 51102
R 8561	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8562	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8563	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8564	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 8565	RES.CHIP	RC-02H 1% 1K21	4822 051 51212
R 8566	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8567	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8568	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8569	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8570	RES.CHIP	RC-02H 1% 348E	4822 051 53481
R 8571	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8572	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8573	RES.CHIP	RC-02H 1% 1K78	4822 051 51782
R 8574	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 8575	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8576	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 8577	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8581	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 8583	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 8586	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 8588	RES.CHIP	RC-02H 1% 261E	4822 051 52611
R 8591	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8592	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8593	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8594	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8596	RES.CHIP	RC-02H 1% 464K	4822 051 54644
R 8597	RES.CHIP	RC-02H 1% 215K	4822 051 52154
R 8598	RES.CHIP	RMC1/8 1% 10E	4822 111 91885

Item	Description		Ordering code
R 8601	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8602	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8603	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8604	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8606	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8607	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8608	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8609	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8611	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 8612	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8621	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8622	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 8658	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8697	RES.CHIP	RC-02H 1% 316K	4822 051 53164
R 8721	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8722	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8723	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8725	RES.CHIP	RC-02H 1% 5K11	4822 051 55112
R 8726	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 8727	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 8728	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 8729	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8730	RES.CHIP	RMC1/8 1% 51E1	5322 111 91893
R 8731	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8732	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8733	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 8734	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 8735	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 8736	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 8737	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 8738	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 8739	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8740	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 8741	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8742	RES.METAL FILM	MRS25 1% 3E16	4822 050 23168
R 8743	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8744	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8745	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 8746	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8747	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 8748	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8749	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 8750	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 8751	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 8752	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 8753	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8754	RES.CHIP	RC-02H 1% 2K15	4822 051 52152
R 8755	RES.CHIP	RMC1/8 1% 42E2	4822 111 91887
R 8756	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 8757	RES.CHIP	RC-02H 1% 7K5	4822 051 57502

Item	Description		Ordering code
R 8758	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8760	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 8761	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 8762	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 8763	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 8764	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 8765	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8766	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 8767	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 8768	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 8769	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 8771	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8772	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 8773	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 8774	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 8775	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8776	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8777	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8778	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8779	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8780	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8781	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8782	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8783	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8784	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8785	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8786	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8787	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8788	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8789	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 8790	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8791	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 8792	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 8793	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8794	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 8795	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 8796	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8797	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 8798	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 8799	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8800	RES.CHIP	RC-02H 1% 51K1	4822 051 55113
R 8801	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8803	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8804	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8805	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8806	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8807	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8808	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8809	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8810	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014

Item	Description		Ordering code
R 8811	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8812	RES.CHIP	RC-02H 1% 464E	4822 051 54641
R 8813	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8814	RES.CHIP	RC-02H 1% 75K	4822 051 57503
R 8815	RES.CHIP	RMC1/8 1% 90E9	5322 111 92018
R 8816	RES.CHIP	RMC1/8 1% 90E9	5322 111 92018
R 8817	RES.CHIP	RMC1/8 1% 90E9	5322 111 92018
R 8818	RES.CHIP	RMC1/8 1% 90E9	5322 111 92018
R 8819	RES.METAL FILM	RC-02H 1% 42K2	5322 116 83718
R 8820	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 8821	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8822	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8823	RES.CHIP	RC-01 5% 5E6	4822 051 10568
R 8824	RES.CHIP	RC-01 5% 5E6	4822 051 10568
R 8825	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8826	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8827	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8828	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8829	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8830	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8831	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 8832	RES.CHIP	RC-02H 1% 100K	4822 051 51004
R 8833	RES.CHIP	RMC1/8 1% 16E2	5322 116 83564
R 8834	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8835	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 8836	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 8837	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 8838	RES.CHIP	RC-02H 1% 215E	4822 051 52151
R 8839	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 8840	RES.MET.GLAZED	RMC1/8 1% 31E6	5322 116 82895
R 8841	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8842	RES.CHIP	RC-01 5% 1E	4822 051 10108
R 8843	RES.CHIP	RC-02H 1% 1K62	4822 051 51622
R 8844	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8845	RES.CHIP	RC-02H 1% 3K83	4822 051 53832
R 8846	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 8847	RES.CHIP	RC-02H 1% 1K47	4822 051 51472
R 8848	RES.CHIP	RC-02H 1% 9K09	4822 051 59092
R 8849	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8850	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 8851	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8852	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 8853	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 8854	CAP.CHIP	RC-02H 1% 2K61	4822 111 91821
R 8855	RES.CHIP	RC-02H 1% 6K81	4822 051 56812
R 8856	RES.CHIP	RC-02H 1% 12K1	4822 051 51213
R 8857	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 8858	RES.CHIP	RC-02H 1% 619E	4822 051 56191
R 8859	RES.CHIP	RC-02H 1% 3K48	4822 051 53482
R 8860	RES.CHIP	RC-02H 1% 17K8	4822 051 51783

Item	Description		Ordering code
R 8861	RES.CHIP	RC-02H 1% 348E	4822 051 53481
R 8862	RES.CHIP	RC-02H 1% 7K5	4822 051 57502
R 8863	RES.CHIP	RC-02H 1% 75K	4822 051 57503
R 8864	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8865	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8866	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8867	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8868	RES.CHIP	RC-02H 1% 562K	4822 051 55624
R 8869	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 8870	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 8871	RES.CHIP	RC-02H 1% 562K	4822 051 55624
R 8872	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8874	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 8875	RES.CHIP	RC-01 5% 4E7	4822 051 10478
R 8876	RES.CHIP	RC-02H 1% 100E	4822 051 51001
R 8877	RES.CHIP	RC-01 5% 3E3	4822 051 10338
R 8878	RES.CHIP	RC-02H 1% 56K2	4822 051 55623
R 8879	RES.CHIP	RC-02H 1% 1K	4822 051 51002
R 8880	RES.CHIP	RMC1/8 1% 10E	4822 111 91885
R 8881	RES.CHIP	RC-02H 1% 237E	4822 051 52371
R 8882	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 8883	RES.CHIP	RC-02H 1% 681E	4822 051 56811
R 8884	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 8885	RES.CHIP	RC-02H 1% 14K7	4822 051 51473
R 8886	RES.CHIP	RC-02H 1% 31K6	4822 051 53163
R 8887	RES.CHIP	RMC1/8 1% 21E5	5322 111 92014
R 8893	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 8894	RES.CHIP	RMC1/8 1% 75E	4822 111 91937
R 8895	RES.CHIP	RC-02H 1% 61K9	4822 051 56193
R 8896	RES.CHIP	RC-02H 1% 10K	4822 051 51003
R 8897	RES.CHIP	RC-02H 1% 16K2	4822 051 51623
R 8898	RES.METAL FILM	MRS16T 1% 100E	4822 050 11001
R 8901	RES.CHIP	RC-02H 1% 38K3	4822 051 53833
R 8902	RES.CHIP	RC-02H 1% 38K3	4822 051 53833
R 8903	RES.CHIP	RC-02H 1% 38K3	4822 051 53833
R 8904	RES.CHIP	RC-02H 1% 38K3	4822 051 53833
R 8905	RES.CHIP	RC-02H 1% 38K3	4822 051 53833
R 8906	RES.CHIP	RC-02H 1% 38K3	4822 051 53833
R 8907	RES.CHIP	RC-02H 1% 38K3	4822 051 53833
R 8908	RES.CHIP	RC-02H 1% 38K3	4822 051 53833
R 8909	RES.CHIP	RC-02H 1% 38K3	4822 051 53833

SEMICONDUCTORS

V 8001	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8002	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8003	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8004	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8006	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513

Item	Description		Ordering code
V 8007	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8008	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8009	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8011	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8012	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8014	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8017	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8018	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8019	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8021	TRANSISTOR,CHIPB	C858C PEL	4822 130 42513
V 8022	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8024	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 8027	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8028	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8029	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8031	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8032	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8033	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8036	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8037	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8038	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8039	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8040	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8041	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8042	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8043	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8044	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8046	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8050	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8054	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8056	TRANSISTOR,CHIP	BFS20 PEL	5322 130 42718
V 8057	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8059	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8061	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8064	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8066	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8067	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8068	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8069	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8071	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8074	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8077	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8078	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8079	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8081	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8082	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8083	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8084	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8086	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8087	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819

Item	Description		Ordering code
V 8088	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8089	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8090	DIODE,CHIP	BZX84-C5V6 PEL	4822 130 80125
V 8091	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8092	DIODE,CHIP	BZX84-C2V4 PEL	4822 130 33703
V 8095	DIODE,CHIP	BZX84-C5V1 PEL	5322 130 32835
V 8096	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8097	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8098	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8099	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8101	DIODE,CHIP	BAV70 PEL	5322 130 34331
V 8103	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8104	DIODE,CHIP	BZX84-C2V4 PEL	4822 130 33703
V 8106	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8107	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8109	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8111	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8112	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8113	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8114	DIODE,CHIP	BZX84-C3V3 PEL	4822 130 33003
V 8122	DIODE,CHIP	BAS28 PEL	5322 130 80214
V 8124	TRANSISTOR,CHIP	BFT93 PEL	5322 130 44824
V 8126	TRANSISTOR,CHIP	BFT93 PEL	5322 130 44824
V 8127	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V 8128	TRANSISTOR,CHIP	BFR31 PEL	5322 130 44787
V 8129	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 8130	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 8131	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 8132	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 8133	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 8134	TRANSISTOR,CHIP	BF512 PEL	5322 130 44875
V 8135	TRANSISTOR,CHIP	BSS83 PEL	5322 130 60502
V 8136	TRANSISTOR,CHIP	BF512 PEL	5322 130 44875
V 8137	INTEGR.CIRCUIT	NDPS5911	5322 209 31301
V 8138	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8139	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8140	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8141	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8142	DIODE,CHIP	BZX84-C2V4 PEL	4822 130 33703
V 8143	DIODE,CHIP	BZX84-C2V4 PEL	4822 130 33703
V 8151	DIODE,CHIP	BAT17 PEL	5322 130 31544
V 8175	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8176	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8177	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8178	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8181	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8182	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8183	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8184	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8185	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819

Item	Description		Ordering code
V 8186	TRANSISTOR,CHIP	BF579 PEL	5322 130 61819
V 8187	DIODE	BBY62 PEL	5322 130 82685
V 8188	DIODE	BBY62 PEL	5322 130 82685
V 8189	DIODE	BBY62 PEL	5322 130 82685
V 8190	DIODE	BBY62 PEL	5322 130 82685
V 8191	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8192	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8193	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8194	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8195	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8196	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8197	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8198	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8199	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8200	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8201	TRANSISTOR,CHIP	BC858C PEL	4822 130 42513
V 8202	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8203	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8204	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8205	TRANSISTOR,CHIP	BC848C PEL	5322 130 42136
V 8207	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8208	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8209	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8210	TRANSISTOR	BD139 PEL	4822 130 40823
V 8212	DIODE,CHIP	BAV99 PEL	5322 130 34337
V 8216	DIODE,CHIP	BAT17 PEL	5322 130 31544
V 8217	DIODE,CHIP	BAT17 PEL	5322 130 31544
V 8218	DIODE,CHIP	BAT17 PEL	5322 130 31544
V 8219	DIODE,CHIP	BAT17 PEL	5322 130 31544
V 8221	DIODE,CHIP	BAT17 PEL	5322 130 31544
V 8222	DIODE,CHIP	BAT17 PEL	5322 130 31544
V 8223	DIODE,CHIP	BAT17 PEL	5322 130 31544
V 8224	DIODE,CHIP	BAT17 PEL	5322 130 31544

CONNECTORS

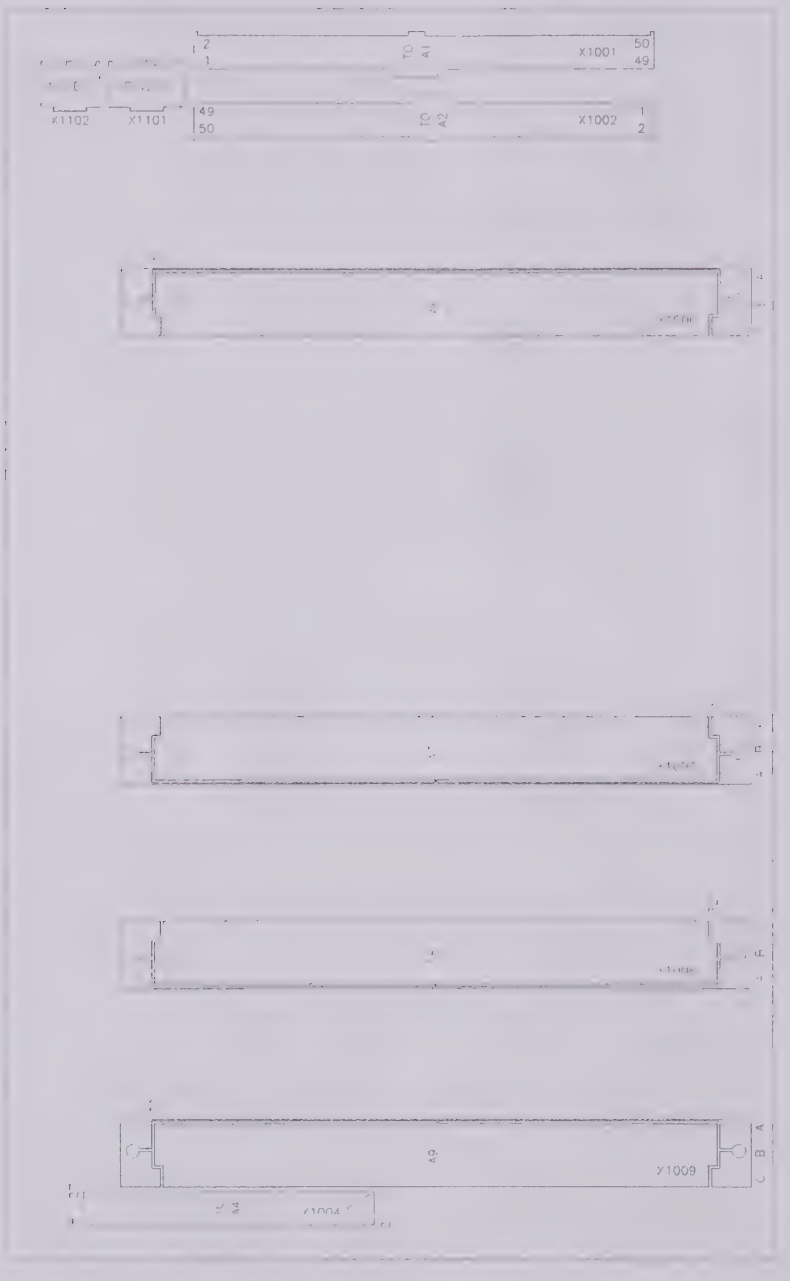
X 1001	CONNECTOR	50-P DBP STRGHT	5322 265 61242
X 1002	CONNECTOR	50-P DBL STRGHT	5322 265 61242
X 1004	CONNECTOR	P 1.25MM STR	5322 267 60311
X 1008	CONNECTOR	64-P 2.54MM	5322 267 70308
X 1011	CONNECTOR	3-P SNG STRGHT	5322 265 30434
X 1012	CONNECTOR	2-P SNG STRGHT	5322 265 20275
X 8001	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 24116
X 8002	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 24116
X 8008	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 24116
X 8009	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 24116

X 8011	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 24116
X 8012	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 24116
X 8018	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 24116
X 8019	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 24116
X 8101	CONNECTOR	96-P PIN 2.54	5322 265 61243
X 8501	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 24116
X 8502	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 24116
X 8503	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 24116
X 8504	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 24116
X 8505	HOLD,OBJECTIVE	INNER PART	5322 268 14141
	HOLD,OBJECTIVE	OUTER PART	5322 268 24116

5.9 RESERVED FOR FUTURE EXTENSIONS

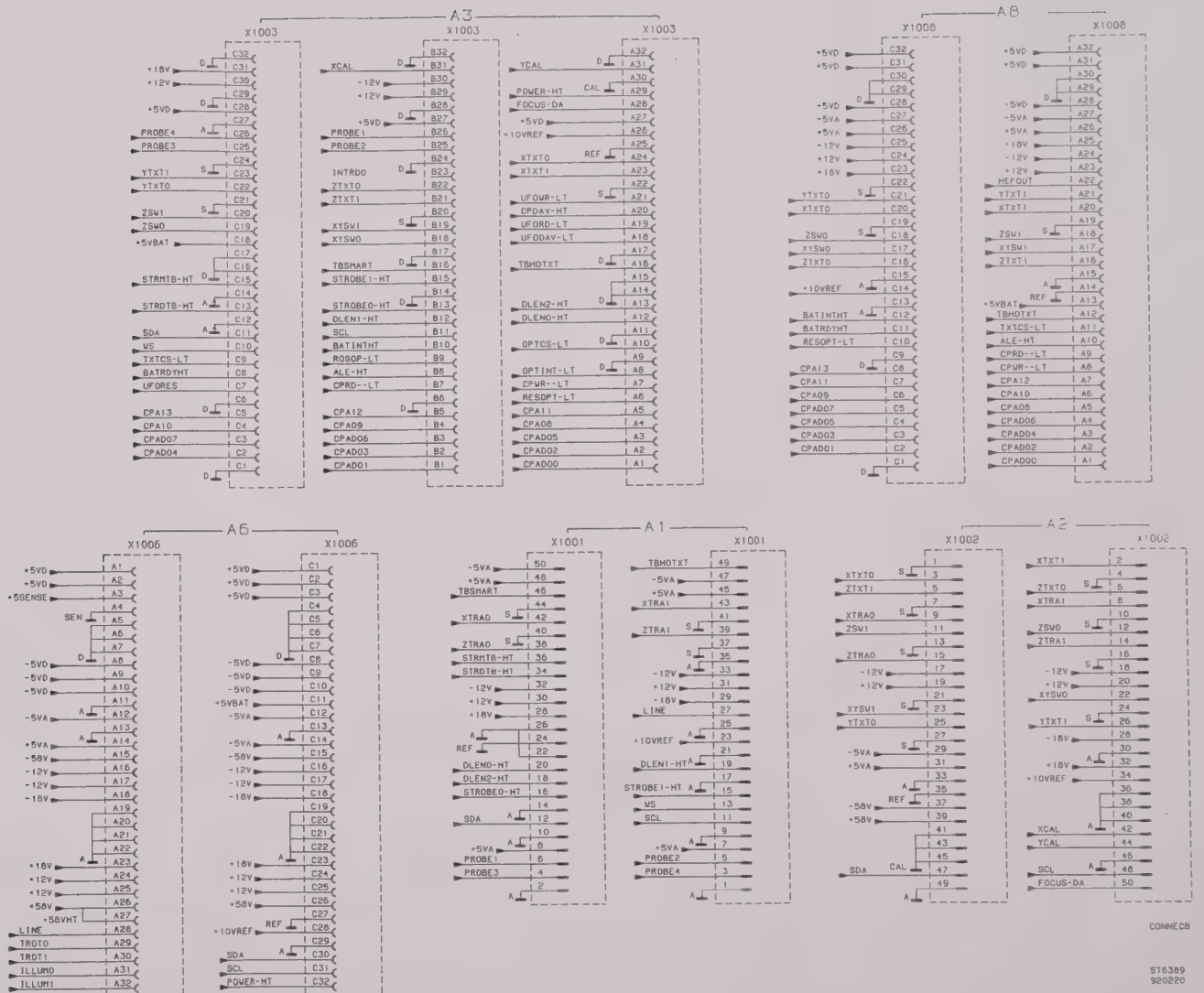
5.10 CONNECTOR BOARD A10

5.10.1 Unit lay-out

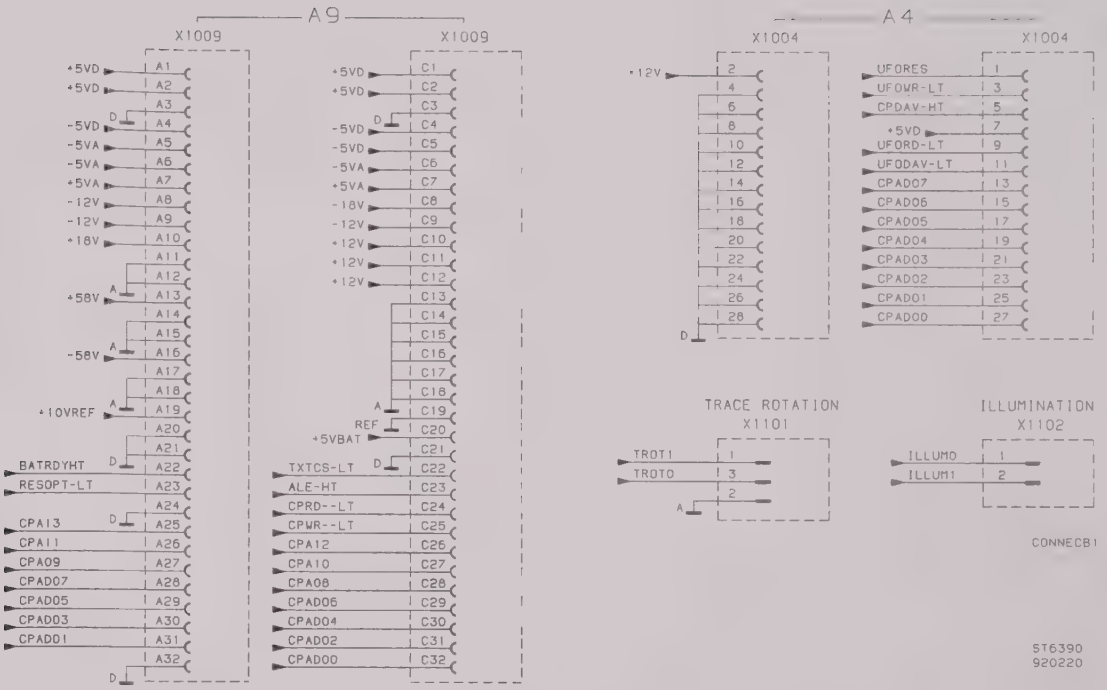


Lay-out 1 - lay-out of connector board A10

5.10.2 Circuit diagram



A10 - Diagram 1; Connectors to unit A1, A2, A3 and A6



A10 - Diagram 2: Connectors to unit A4, A9, trace rotation and illumination

5.10.3 Parts list

CONNECTORS

Item	Description		Ordering code
X 1001	CONNECTOR	50-P DBL STRGHT	5322 265 61242
X 1002	CONNECTOR	50-P DBL STRGHT	5322 265 61242
X 1003	CONNECTOR	96-P 2.54MM	5322 267 51108
X 1004	CONNECTOR	P 1.25MM STR	5322 267 60311
X 1006	CONNECTOR	64-P 2.54MM	5322 267 70308
x 1008	CONNECTOR	96-P 2.54MM	5322 267 51108
X 1009	CONNECTOR	96-P 2.54MM	5322 267 51108
X 1011	CONNECTOR	3-P SNG STRGHT	5322 265 30434
X 1012	CONNECTOR	2-P SNG STRGHT	5322 265 20275

5.11 FACTORY INSTALLED OPTIONS

5.11.1 IEEE-OPTION

This option enables the oscilloscope to be controlled by an IEEE-system using the SCPI protocol (SCPI = Standard Commands for Programmable Instruments). The IEEE connector is located at the rear panel of the oscilloscope. The version number of this factory-installable option is /40. The interface circuitry is located at the microprocessor unit A3. The specification of the interface is given in chapter 2.17. Programming data is given in a separate 'SCPI Programming Manual'.

The description is a part of the explanation of the complete unit A3 and is given in chapter 5.3. The IEEE-option requires additional software and thus requires an additional flash-ROM D1015. The IEEE-components in an oscilloscope without IEEE- option are not inserted.

5.11.2 AUXILIARY OUTPUTS OPTION

Introduction

This option comprises 3 rear panel BNC outputs that provide Y- out, MTB-gate-out and DTB-gate-out signals. The characteristics of the output signals are listed in chapter 2.16.3 'Optional outputs' in this manual. This option is always combined with the EXTTRIG option (see section 5.11.3).

General description

MTB-gate-out and DTB-gate-out are realized by adding rear panel BNC sockets and coaxial interconnection cables. The coaxial cables lead to the already existing 2-pole connectors on signal unit A1. The necessary circuitry is already present on unit A1. Refer for this to figure 1. The Y- out requires a small printed circuit board, a rear panel BNC socket and a coaxial interconnection cable. The small printed circuit board is equipped with soldering pins that fit directly into unit A1. The lay-out of this unit is given in figure 2; the belonging circuit diagram in figure 3.

Circuit description

The balanced input signals for the Y-out unit are FNCYOP0 and FNCYOP1. The signals originate from pin 5 and 6 of D1301 in the Y-functions section of signal unit A1.
The input current signal is applied to common base circuit V1001/V1002. Then it is applied as current signal to pin 9 and 8 of N1001. The output current signals are routed from pin 11 and 6 to pin 13 and 16. The voltage signal at output pins 12 is used as feedback via C1002/R1009. The voltage signal at output pin 1 is used as output signal via the emitterfollowers N1001/2,3,4 and V1006. Feedback is achieved via R1024/C1011.

Parts list

Item number	Description	Service ord code
C 1001	10nF/63V	5322 122 34098
C 1002	3.3pF/63V	5322 122 32286
C 1006	1pF/63V	5322 122 32447
C 1009	10pF/63V	5322 122 32448
C 1011	2.7pF/63V	5322 122 31873
C 1012	10nF/63V	5322 122 34098
C 1013	10nF/63V	5322 122 34098
C 1014	5.6pF/63V	5322 122 32967
C 1017	22nF/63V	5322 122 32654
C 1018	100nF/63V	4822 122 33496
C 1019	100nF/63V	4822 122 33496
C 1021	100nF/63V	4822 122 33496

Item	Description	Service ord code
R 1001	12k1/1%	4822 051 51213
R 1002	1k33/1%	4822 051 51332
R 1003	1k/1%	4822 051 51002
R 1004	51E1/1%	5322 111 91893
R 1006	5k11/1%	4822 051 55112
R 1007	825E/1%	4822 051 58251
R 1008	825E/1%	4822 051 58251
R 1009	21E5/1%	5322 111 92014
R 1011	4E7/5%	4822 051 10478
R 1012	4E7/5%	4822 051 10478
R 1013	100E/1%	4822 051 51001
R 1014	100E/1%	4822 051 51001
R 1015	5k11/1%	4822 051 55112
R 1016	5k11/1%	4822 051 55112
R 1017	1k33/1%	4822 051 51332
R 1018	147E/1%	4822 051 51471
R 1019	348E/1%	4822 051 53481
R 1021	1k/1%	4822 051 51002
R 1022	1k/1%	4822 051 51002
R 1023	147E/1%	4822 051 51471
R 1024	51E1/1%	5322 111 91893
R 1026	100E/1%	4822 051 51001
R 1027	100E/1%	4822 051 51001
R 1028	750E/1%	4822 051 57501
R 1029	1k33/1%	4822 051 51332
R 1031	51E1/1%	5322 111 91893
R 1032	5k11/1%	4822 051 55112
R 1033	511E/1%	4822 051 55111
R 1034	147E/1%	4822 051 51471
R 1036	1k/1%	4822 051 51002
R 1037	51E1/1%	5322 111 91893
R 1038	511E/1%	4822 051 55111
R 1039	511E/1%	4822 051 55111
R 1041	4E7/5%	4822 051 10478
R 1042	4E7/5%	4822 051 10478
R 6101	1k/1%	4822 051 51002
R 8053	1E/5%	4822 051 10108
R 8073	1k/1%	4822 051 51002
R 8137	3k16/1%	4822 724 53162
R 8138	3k16/1%	4822 724 53162
V 1001	BF579	5322 130 61819
V 1002	BF579	5322 130 61819
X 1011	Male Header	5322 265 20525

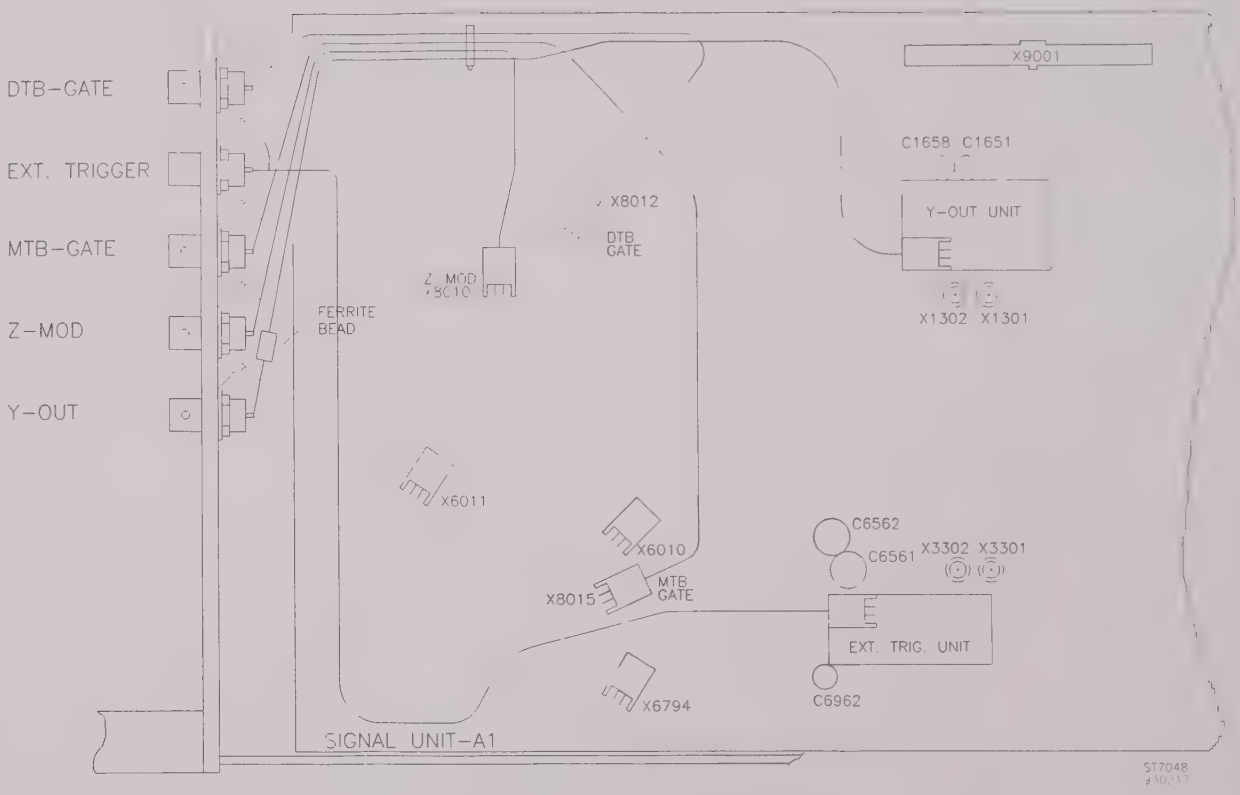


Fig.1. Location of options Y-out and external trigger

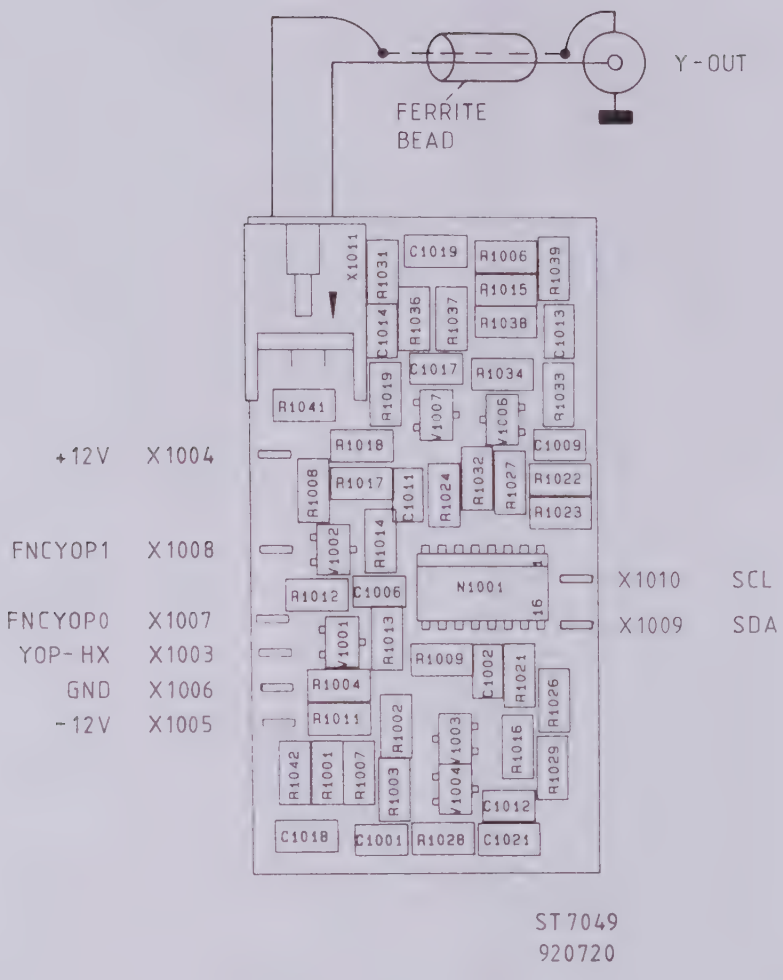


Fig. 2. Printed circuit board lay-out of Y-out unit

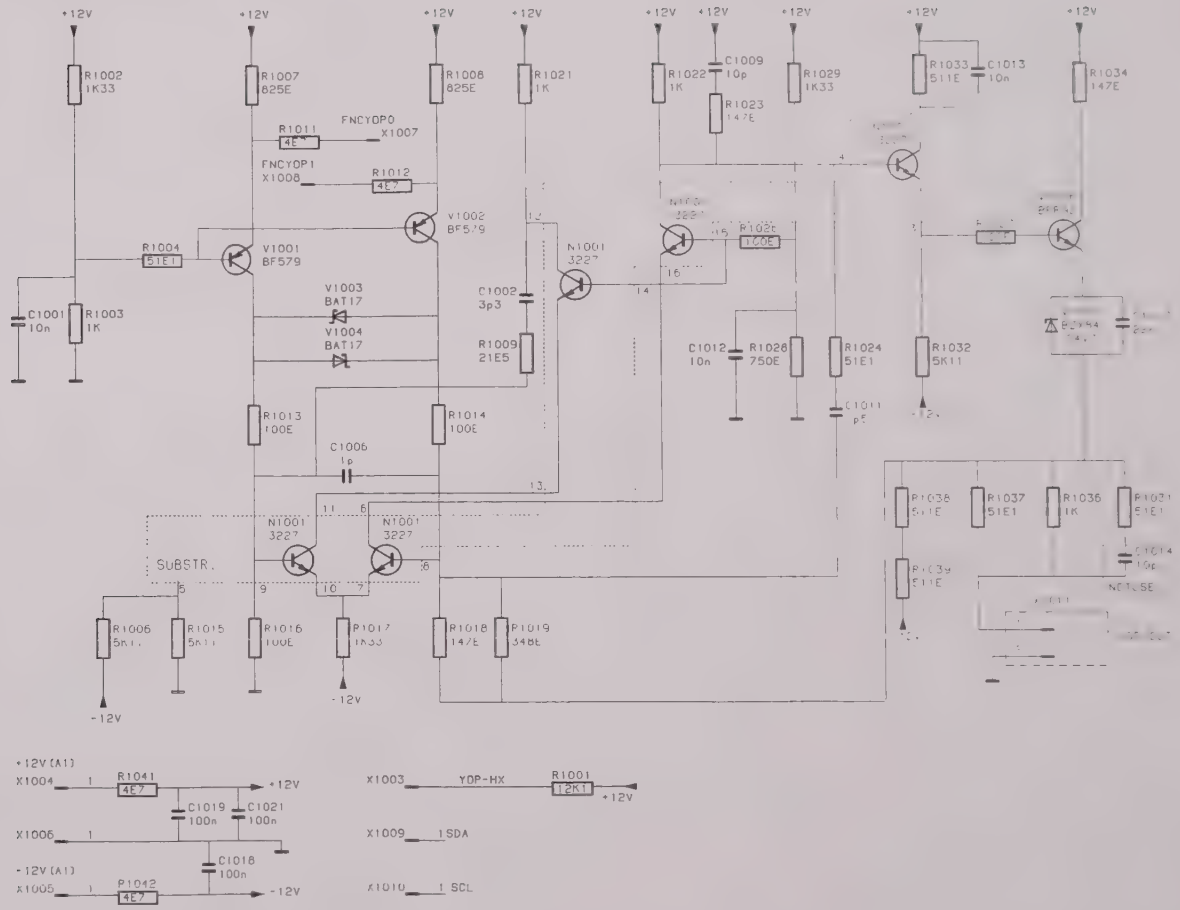


Fig. 3. Circuit diagram of Y-out unit

5.11.3 EXTERNAL TRIGGER OPTION

Introduction

The External Trigger Input option provides an extra input at the rear of the oscilloscope. This input can be used as the trigger source for the Main Time Base (MTB). The option is factory-installable only. The external trigger requires a small printed circuit board, a rear panel BNC socket and a coaxial interconnection cable.

The small printed circuit board is equipped with soldering pins that fit directly into unit A1. Refer to figure 1 for the exact location. The lay-out of this unit is given in figure 4; the belonging circuit diagram in figure 5.

The EXT TRIG input is suitable for use with the supplied 10:1 probe. The input characteristics are similar to those of CH1...CH4.
If External is chosen as trigger source, then the following trigger functions remain available:
- trigger filters ac, dc, lf_rej and hf_rej
- level-pp function
- +/- slope selection
- noise on/off

If External trigger is chosen as trigger source, then TV trigger mode is not available.
Line (50/60 Hz mains) as trigger source is not available.
If the External trigger option is present together with 'Y- out' option, then the DTB gate output of the Y-out is not available.

A diode V7801 (BAV99, 5322 130 34337) is added on signal unit A1. This diode is connected to the 'panel version identification' circuit D9013. By means of this, the internal software knows that the external trigger option is present. Diode V7801 is located on unit A1 between V7802 and R7077.

Characteristics

The following has to added to chapter 2.3.1 of 'characteristics'.

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
Source		
SOURCE(S)	CH1 ... CH4	
MTB- triggering	External	No line triggering
	Composite	
Input characteristics		
INPUT CONNECTOR	BNC	At rear of instrument
INPUT IMPEDANCE		Measured at freq.<1MHz
R paralle		
- value	1 MΩ	
- tolerance	±1 %	
C parallel		
- value	25 pF	
- tolerance	±5 pF	
DYNAMIC RANGE		
Up to 10 MHz	±2.5 V	Symmetrical

CHARACTERISTICS	SPECIFICATION	ADDITIONAL INFORMATION
INPUT VOLTAGE LIMITS		See note 1
(d.c. + a.c. peak)	±400 V	See note 2

Note 1: Apparatus should be properly grounded through the protective ground conductor of the power cord.

Note 2: Up to 10 kHz; > 10kHz see figure 1.1.

Sensitivity

EDGE TRIGGER SENSITIVITY		See note 3
d.c. to 5 MHz	100 mV	
d.c. to 10 MHz	200 mV	

Note 3: In noise-trigger multiply stated value by 2.

Trigger level

Range	±1.5 V	See note 4
Accuracy	≤0.4 V	at 1 kHz inputsignal triggercoupling DC

Note 4: With Level-pp on the range is restricted to the peak- peak value of the trigger signal.

Circuit description

Refer to figure 5 for the circuit diagram. The input signal is routed via RC circuit R1001/C1002 and a coaxial cable to the small printed circuit board. Via protection diodes V2002 the signal is applied to the operational amplifier N2021. This device functions as amplifier and level shifter. The analog multiplexer D2031 the output signal MTRIGEXT. This signal is applied to the base of transistor V6507 in the MTB trigger section on unit A1 (diagram 12). Multiplexer D2031 applies -9 V (-9EXT) to the diodes V2012 if the external trigger signal is not needed. This suppresses the signal directly at the input.

Parts list

Item number	Description	Service ord code
C 1001	33pF/500V	4822 122 31202
C 2082	47uF/25V	4822 124 20699
C 2091	47uF/25V	4822 124 20699
C 2001	56pF/63V	5322 122 32661
C 2003	100nF/63V	4822 122 33496
C 2004	100nF/63V	4822 122 33496
C 2011	10nF/63V	5322 122 34098
C 2016	100nF/63V	4822 122 33496
C 2021	100pF/63V	5322 122 32531
C 2023	33pF/63V	5322 122 32659
C 2032	100nF/63V	4822 122 33496
C 2082	100nF/63V	4822 122 33496
C 2086	100nF/63V	4822 122 33496
C 2092	100nF/63V	4822 122 33496
C 2094	100nF/63V	4822 122 33496

Item	Description	Service ord code
D 2031	HEF4053BT	5322 209 14481
R 1001	750k/0.25%	5322 116 53588
R 2001	511k/1%	4822 051 55114
R 2002	511k/1%	4822 051 55114
R 2013	10M/5%	4822 051 10106
R 2014	10M/5%	4822 051 10106
R 2021	261E/1%	4822 051 52611
R 2022	14k7/1%	4822 051 51473
R 2023	1k47/1%	4822 051 51472
R 2024	3k16/1%	4822 051 53162
R 2033	1k47/1%	4822 051 51472
R 2051	14k7/1%	4822 051 51473
R 2052	2k15/1%	4822 051 52152
R 2054	5k11/1%	4822 051 55112
R 2061	2k15/1%	4822 051 51252
R 2062	14k7/1%	4822 051 51473
R 2063	5k11/1%	4822 051 55112
R 2081	4E7/5%	4822 051 10478
R 2086	4E7/5%	4822 051 10478
R 2091	4E7/5%	4822 051 10478
R 2094	5k11/5%	4822 051 55112
V 2002	BAS28	5322 130 80214
V 2012	BAS28	5322 130 80214
V 2053	BC848C	5322 130 42136
V 2064	BC858C	4822 130 42513
V 2093	BZX84-C3V0	5322 130 32739
X 2001	Male Header	5322 265 20525

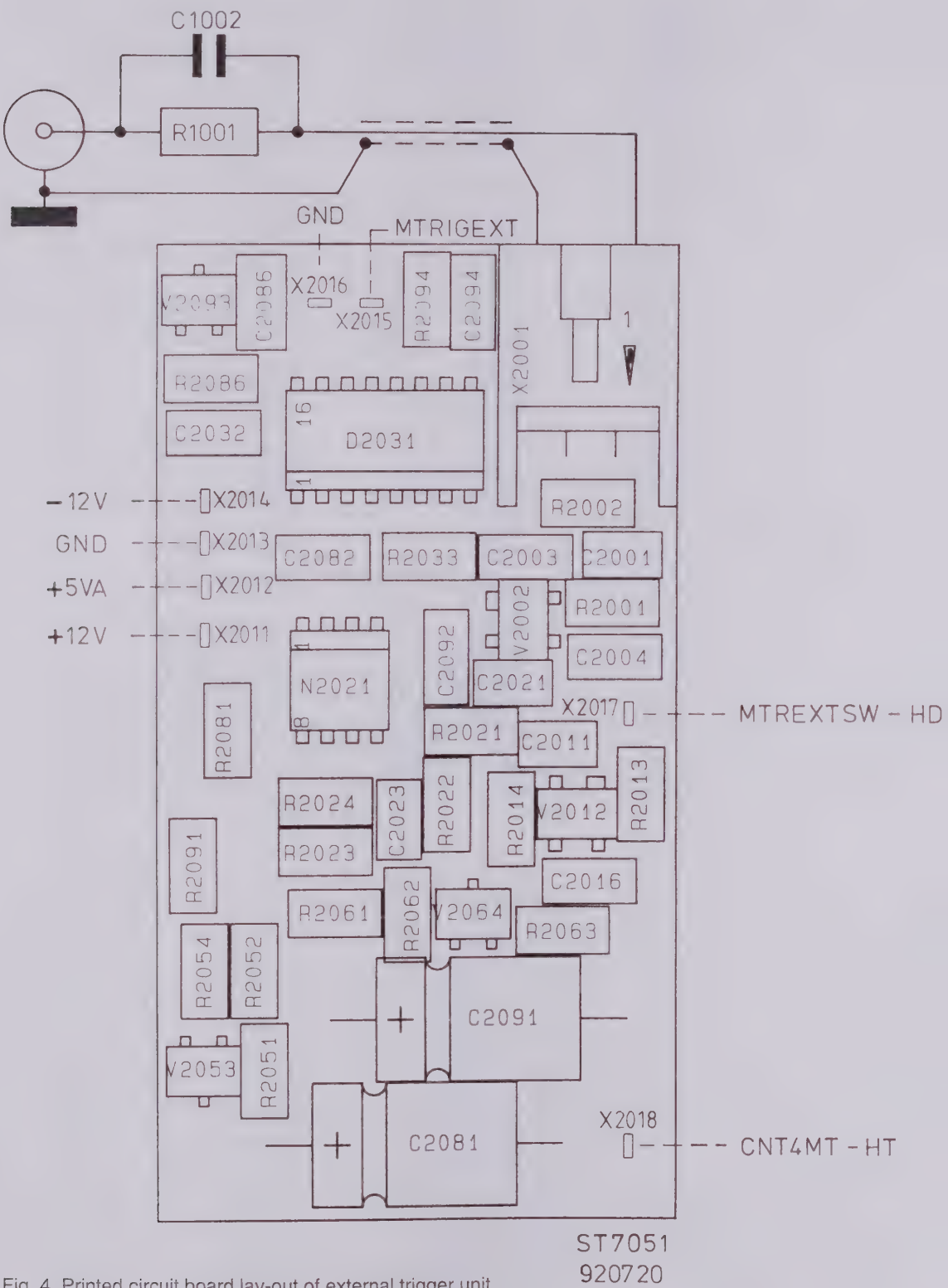
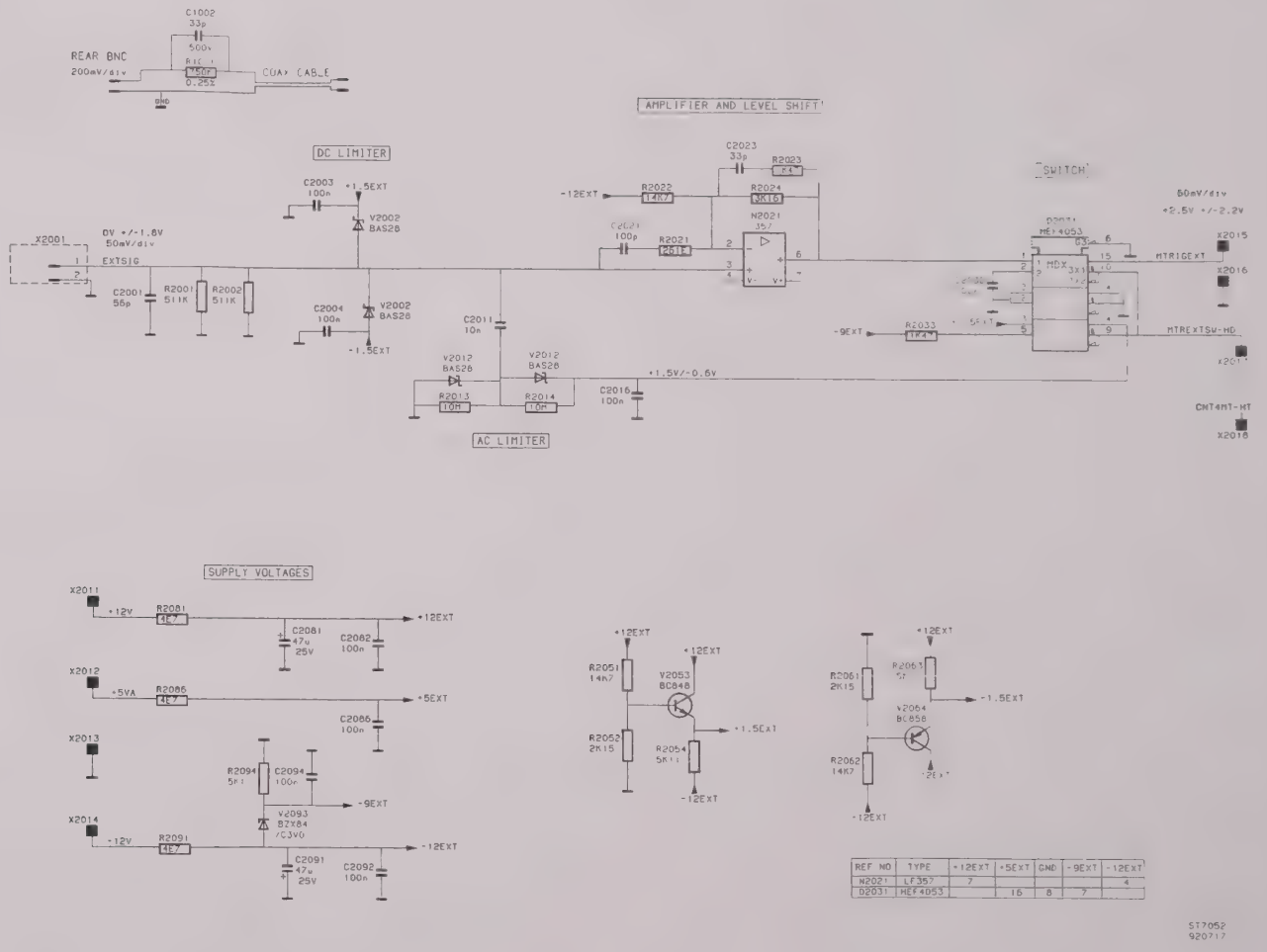


Fig. 4. Printed circuit board lay-out of external trigger unit



REF NO	TYPE	+12EXT	+5EXT	GND	-9EXT	-12EXT
N2021	LF357	7				4
D2031	HEF4053		16	8	7	

ST7052
920717

Fig. 5. Circuit diagram of external trigger unit

6 PERFORMANCE TEST

6.1 GENERAL INFORMATION

WARNING: Before turning on the instrument, ensure that it has been installed in accordance with the Installation Instructions, outlined in Section 2 of the Operation Guide.

This procedure is intended to:

- Check the instrument's specification.
- Be used for incoming inspection to determine the acceptability of newly purchased instruments and/or recently recalibrated instruments.
- Check the necessity of recalibration after the specified recalibration intervals.

NOTE: The procedure does not check every facet of the instrument's calibration; rather, it is concerned primarily with those parts of the instrument which are essential to measurement accuracy and correct operation. Removing the instrument covers is not necessary to perform this procedure. All tests are made from the outside of the instrument.

If the test is started shortly after turning on the instrument, steps may be out of specification, due to insufficient warm up time. Be sure to allow the full warm up time of 35 minutes (under average conditions).

The tests are made with a stable, well-focused, low-intensity display. Unless otherwise noted, adjust the intensity, position, and trigger level controls as needed.

IMPORTANT NOTES

- The input voltage must be supplied to the CH1 input, unless otherwise stated. Set the MAIN TB TIME/div key pair to a suitable position, unless otherwise stated.
- Tolerances given are for the instrument under test and do not include test equipment error. Bear in mind that the test equipment and connecting cables are properly terminated. Usually, this termination must be 50Ω. This is achieved with a 50Ω termination at the end of the cable. Such termination is not necessary for the PM3394 (all channels), or CH1, CH2 of the PM3392; these oscilloscopes feature switchable internal 50Ω input impedance.
- In some tests vertical channels CH2, CH3, CH4 appear in parentheses after CH1, e.g., CH1 (CH2, CH3, CH4). This indicates that the CH1 test should be performed first, followed by the tests for CH2, CH3 and CH4.
- Some of the tests are not necessary for all four oscilloscope types. This is indicated as necessary. The test step may then be skipped.
- Where required, tests are done in either analog or digital mode. Switching between analog and digital mode is done by pressing the DSO key. When you enter either analog or digital mode, the display indicates 'ANALOG MODE' or 'DIGITAL MODE'.

6.2 RECOMMENDED TEST EQUIPMENT

Note: the digital multimeter and oscilloscope are not required for this test.

Type of instrument	Required specification	Example of recommended instrument
Function generator	Freq: 50 Hz...10 MHz Sine wave/square-wave Ampl: 0...20V (pp) DC offset -5...+5V Rise time ≤30 ns Duty cycle 50%	Philips PM5134 or PM5138
Constant amplitude sine wave generator	Freq: 50 kHz...250 MHz Constant pp. amplitude of 120 mV to 3V.	Tektronix SG 503
Constant amplitude sine wave generator	Freq: 50 kHz...300 MHz. Constant pp. amplitude of 120 mV to 3V	Tektronix SG 504 To check the trigger sensitivity in PM3392/94
Square-wave calibration generator	For ampl. calibration: Freq: 1 kHz Ampl: 10 mV...50 mV For rise time measurements: Freq: 1 MHz Ampl: 10...900 mV Rise time: ≤1 ns	Tektronix PG 506
Time marker generator	Repetition rate: 0.5s...2 ns	Tektronix TG 501
Digital multimeter	Wide voltage and current ranges.	Philips PM2525 with AC, DC and resistance ranges. High voltage probe. Required: 1% accuracy, PM9246
Variable voltage transformer (VARIAC)	Well insulated output voltage 90...264V (ac)	Philips order. number 2422 529 00005
TV pattern generator with video output		
Oscilloscope	The bandwidth must be the same or higher than the bandwidth of the instrument under test.	Philips PM3394
50Ω cables, 75Ω cable, 50Ω terminations, 75Ω termination, 10:1 attenuator, T-piece, power splitter	Tektronix and Philips BNC types for fast rise time square-wave, high frequency sine wave and other applications.	TEK 012-0482-00 TEK 012-0074-00 TEK 011-0049-01 TEK 011-0055-01 TEK 011-0059-02 PHI PM9067 PHI PM9584/02

6.3 TEST PROCEDURE

6.3.1 Preliminary settings

Test equipment:

None

Settings/procedure and requirements:

1 - If not present install 2 penlight (LR6) back up batteries in the holder at the rear panel of the oscilloscope.
2 - Turn on the oscilloscope under test.
3 - Press the STATUS and TEXT OFF keys simultaneously. This assures that the oscilloscope follows the default reaction when the green AUTOSET key is pressed. You can verify that the oscilloscope is in analog mode by pressing the STOP key. If you are in analog mode, the message 'PLEASE FIRST SWITCH TO DSO' is displayed. The now following steps are applicable for PM3392 and PM3394.
4 - Press the UTIL menu key to display the UTIL menu.
5 - Press softkey AUTOSET to display the UTIL AUTOSET menu.
6 - Press the relevant softkey to put the oscilloscope in the 'userprog' mode; the text 'userprog' must be intensified.
7 - Press softkey VERT.
8 - Select with softkey '1MΩ / 50Ω / unaffect' the 'unaffect' position.
9 - Check for the instrument settings in the lower part of the viewing area: when not available press TEXT OFF until the maximum amount of information is displayed.

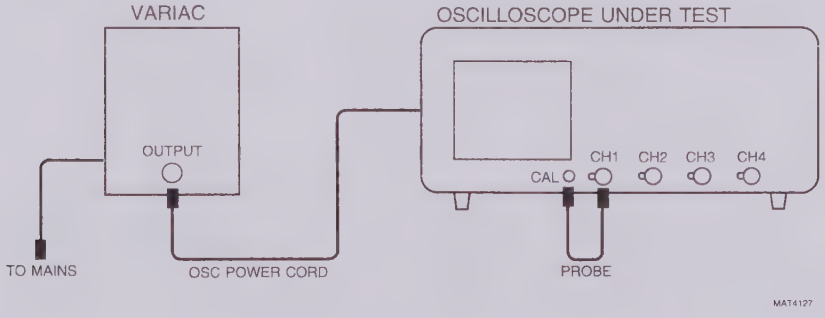
6.3.2 Power supply

This test checks the proper operation of the power supply at all possible line voltages.

Test equipment:

Variable voltage transformer (VARIAC)

Test set-up:



Settings/procedure:

1 - Adjust the input line voltage to the oscilloscope (output from VARIAC) to a desired value between 100 and 240V (rms), frequency 50...400 Hz.
2 - Press POWER ON on the oscilloscope.
3 - Apply the CAL signal from the front panel of the oscilloscope to input CH1, e.g., by means of a 10:1 probe.
4 - Press the green AUTOSET key.

Requirements:

1 - Verify that the oscilloscope starts at any input voltage between 100 and 240V; in particular the line voltages 100, 120, 220 and 240V must be checked.
2 - Verify that the instrument's performance does not change over the indicated voltage range; and that the displayed CAL signal is distortion-free and has equal intensity.
3 - Press the DSO key ('DIGITAL MODE' is displayed briefly), and verify that the instrument's performance does not change in digital mode at the indicated line voltages (100, 120, 220 and 240V). The displayed CAL signal must be free from distortion.

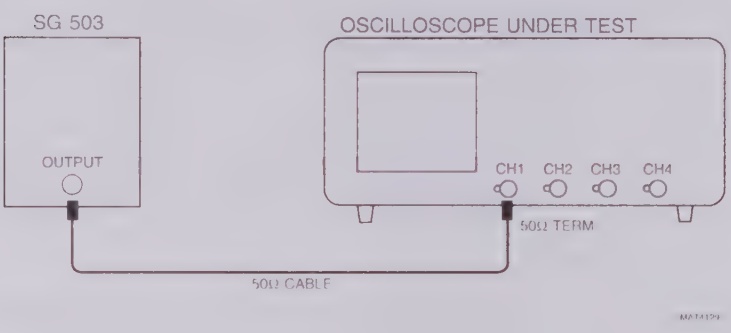
6.3.3 Auto set

This test checks the correct working of the AUTOSET function.

Test equipment:

Constant amplitude sine wave generator (SG 503)

Test set-up:



Settings/procedure:

1 - Apply a 10 MHz sine wave signal of 600 mV (pp into 50Ω) to input CH1;.
2 - Press the green AUTOSET key. Use a 50Ω termination at the end of the coax cable. For instruments with switchable 50Ω input impedance it is recommended to use the internal termination (when active, the text 'LZ' appears in the lower part of the viewing area). For instruments without internal termination, an external termination should be used.

Requirements:

1 - Verify that the displayed waveform is stable and properly triggered. Amplitude should be within the screen area. Horizontally some signal periods should be displayed.
2 - Repeat the same settings and procedure for CH2, CH3 and CH4.
3 - Press the DSO key to return to analog mode. The message 'ANALOG MODE' appears briefly.
4 - Repeat the AUTOSET check in the analog mode for CH2, CH3, and CH4.

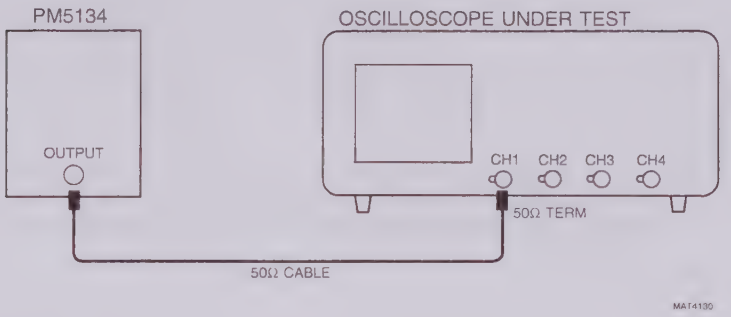
6.3.4 Orthogonality

This test checks the angle between the horizontal and vertical deflection plates (orthogonality).

Test equipment:

LF sine wave generator (function generator PM5134 or PM5138)

Test set up:



Settings/procedure:

1 - Press the CAL key for a few seconds to start the autocal procedure. This takes approximately just more than one minute. When ready, the oscilloscope is fine tuned to optimal accuracy.
2 - Apply a 50 Hz sine wave signal of 8V (pp into 50Ω) to input CH1;
3 - Press the AUTOSET key and adjust the input signal to a trace- height of 8 div (CH1 in 1V/div). Use a 50Ω termination at the end of the cable. For instruments with switchable 50Ω input impedance the use of the internal termination is recommended.
4 - Activate the GND function and verify that the straight line is exactly parallel to the horizontal graticule lines. If not, readjust the TRACE ROTation.
5 - Switch the GND function off and verify that a signal of 8 divisions is displayed.
6 - Press the DISPLAY menu key.
7 - Press the X-DEFL softkey.
8 - Select 'on' and 'ch2' from the X-DEFL menu.
9 - Use the X POS control to move the vertical line to the center of the screen.

Requirements:

1 - Verify that the vertical line is parallel to the vertical graticule line in the center of the screen.
2 - Verify that the angle with respect to the horizontal graticule lines is 90° ± 0.5° as indicated in the figure.

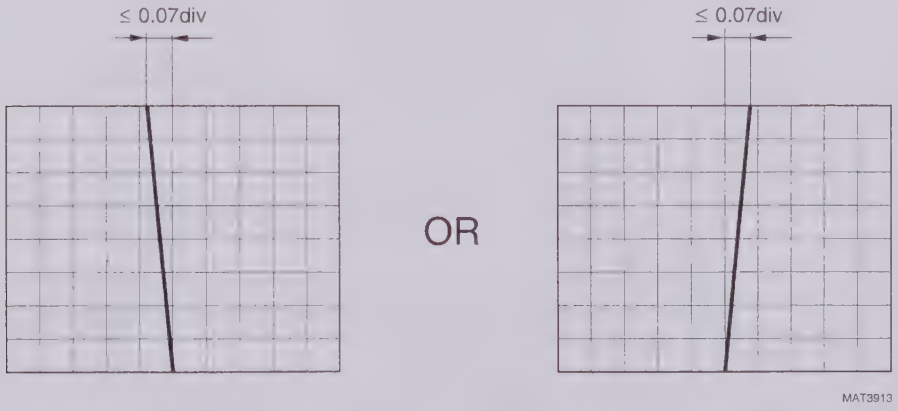


Figure 6.1 Orthogonality

6.3.5 Trace distortion

This test checks the distortion of a horizontal line in the central 6 x 8 divisions of the screen.

Test equipment:

None

Settings/procedure:

1 - Press the AUTOSET key with no input signal applied to the scope.
2 - Use the CH1 POS control to shift the timebase line vertically across the center 6 divisions of the screen.

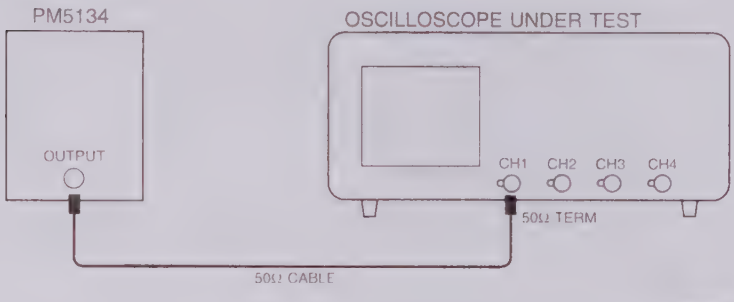
Requirements:

Verify that the deviation from the ideal straight line does not exceed 0.03 divisions in the center of screen and 0.1 divisions elsewhere.

Test equipment:

LF sine wave generator (function generator PM5134 or PM5138)

Test set-up:



Settings/procedure:

1 - Apply a 50 Hz sine wave signal of 8V (pp into 50Ω) to input CH1;
2 - Press the AUTOSET key and adjust the input signal to an amplitude of 8 divisions (CH1 in 1V/div). Use an external 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature.
3 - Using the CH1 POS control, adjust the display around the center of the screen.
6 - Press the DISPLAY menu key.
7 - Press the X-DEFL softkey.
8 - Select 'on' and 'ch2' from the X-DEFL menu.
9 - Use the X POS control to shift the vertical line across the middle eight divisions of the screen.

Requirements:

Verify that the deviation from the ideal straight line does not exceed 0.03 divisions in the center of screen and 0.1 divisions elsewhere.

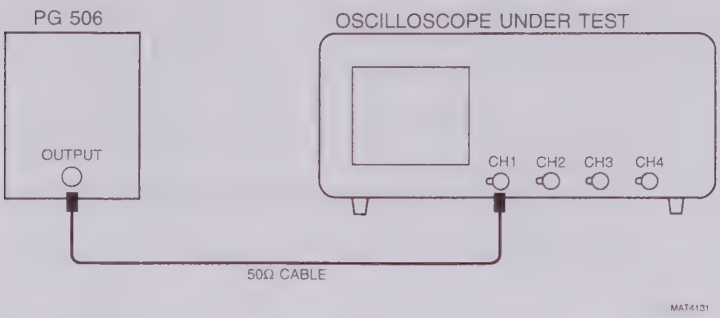
6.3.6 Vertical deflection; deflection coefficients

The vertical deflection coefficients of channels CH1, CH2, CH3, and CH4 are checked by means of a calibrated signal.

Test equipment:

Square-wave calibration generator (PG 506)

Test set up:



Settings/procedure:

1 - Apply a 1 kHz square-wave signal of 20 mV to input CH1. Set the generator in position STD AMPL. The generator must not be terminated with 50Ω (the text 'LZ' must not be visible in the lower part of the viewing area).
2 - Press the green AUTOSET key.
3 - Set CH1 to 5 mV/div and to DC input coupling. The waveform must be in the vertical middle of the screen.
4 - Press the ACQUIRE menu key.
5 - Select BW LIMIT 'on' from the FILTER menu.
6 - Press the TRIGGER menu key.
7 - Select noise 'on' and 'hf-rej' from the TRIGGER MAIN TB menu.
8 - Change the input voltage and the setting of CH1 according to table I and verify that the amplitude of the signal agrees with this table. The signal should remain positioned in the vertical center of the screen.

Note: Only the input sensitivities essential for input accuracy are checked.

Requirements:

table I.

Input voltage (pp)	Setting	Requirements analog mode:	Requirements digital mode:
20 mV	5 mV	3.94...4.06 div (+/- 1.3%)	3.92...4.08 div (+/- 2%)
50 mV	10 mV	4.93...5.07 div (+/- 1.3%)	4.9...5.1 div (+/- 2%)
1V	0.2V	4.93...5.07 div (+/- 1.3%)	4.9...5.1 div (+/- 2%)
5V	1V	4.93...5.07 div (+/- 1.3%)	4.9...5.1 div (+/- 2%)

Repeat the settings/procedure in table I for CH2, CH3 and CH4. Use table II for CH3 and CH4 in PM3392 and PM3382.

table II.

Input voltage (pp)	Setting	Requirements analog mode:	Requirements digital mode:
0.5V	0.1V	4.93...5.07 div (+/- 1.3%)	4.9...5.1 div (+/- 2%)
2V	0.5V	3.94...4.06 div (+/- 1.3%)	3.92...4.08 div (+/- 2%)

- Press the DSO key ('DIGITAL MODE' is displayed briefly), and repeat the tests in this chapter for the digital mode.
- Press the DSO key ('ANALOG MODE' is displayed briefly) to return to analog mode.

6.3.7 Vertical deflection; variable gain control range (continuation of 4.3.6)

This test checks the vertical VARiable gain control.

Settings/procedure:

1 - Apply a square-wave signal of 0.2V to input CH1 and press AUTOSET.
2 - Set CH1 to 50 mV/div and input coupling to DC. Using the CH1 POS control, center the waveform in the screen.
3 - Select the VARiable mode by simultaneously pressing both AMPL keys. The readout changes into 50.0 mV/div.
4 - Press the mV key to adjust an input sensitivity of 40.0 mV/div.

Requirements:

1 - Verify that the displayed amplitude is between 4.86 and 5.14 divisions (+/- 2.8%).
2 - Repeat the settings and procedure for CH2. For the PM3394 and PM3384 repeat the same steps for CH3 and CH4.

6.3.8 Vertical deflection; input coupling (continuation of 4.3.7)

This test verifies the operation of the AC input coupling. Also, the operation of the ground (GND) function is checked.

Settings/procedure:

1 - Switch the CH1 VARiable mode off by simultaneously pressing both AMPL/VAR keys. The readout changes to 50 mV.
2 - CH1 sensitivity is 50 mV/div; the vertical deflection is now 4 divisions.

Requirements:

1 - Activate the CH1 GND function and verify that a horizontal line is displayed.
2 - Select the AC input coupling and verify that a 4 divisions square-wave signal is displayed. Center this signal in the middle of the screen.
3 - Select the DC input coupling and verify that the 4 divisions square-wave signal moves up. This shift is caused by the signal's positive dc component: this component is not blocked in DC coupled mode.

Repeat the settings and procedure for CH2, CH3, and CH4. In the PM3392 and PM3382, the test of the GND and AC function is skipped for CH3 and CH4.

6.3.9 Vertical cursor accuracy (continuation of 4.3.8.)

This test verifies the accuracy of the voltage cursors

Settings/procedure:

1 - Change the generator output voltage to 0.1V.
2 - Apply this voltage to CH1.
3 - Switch CH1 to ON, and switch the other channels off.
4 - Select DC coupled input and 20 mV/division for CH1.
5 - Select CH1 as trigger source (TRIG 1).
6 - Use the POS control to center the 5 division square wave on the dotted horizontal lines of the graticule.
7 - Press the CURSORS menu key.
8 - Select 'on' and volt cursors (=) from in the CURSORS menu.
9 - Select Δ V from the READOUT menu.

Requirements:

1 - Use the TRACK and Δ controls to position both cursor lines exactly on top and bottom of the signal. Check for a cursor readout between 98.4 and 101.6 mV.
2 - Press the DSO key ('DIGITAL MODE' is displayed briefly) and repeat the check in this chapter for the digital mode.
3 - Press the DSO key ('ANALOG MODE' is displayed briefly) to return to analog mode.

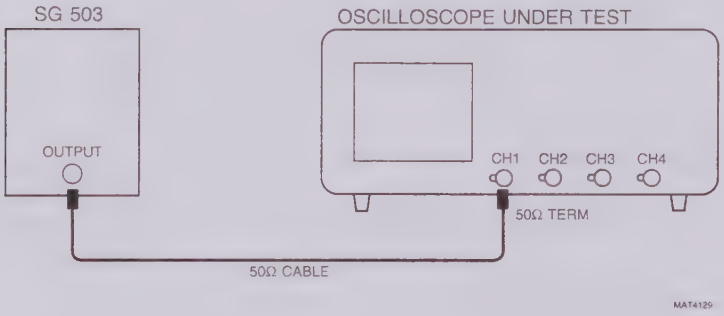
6.3.10 Vertical deflection; high-frequency response

This test verifies the upper transition point of the vertical bandwidth.

Test equipment:

Constant amplitude sine wave generator (SG 503)

Test set-up:



Settings/procedure:

1 - Apply a 50 kHz sine wave signal of 600 mV (pp into 50Ω) to input CH1, and press the AUTOSET key.
2 - Use an external 50Ω termination. Use the internal termination of the oscilloscope, when available (if active, the text 'LZ' is visible in the lower part of the viewing area).
3 - Set CH1 to 0.1V/div.
4 - Adjust the input signal to an amplitude of exactly 6 divisions.
5 - Slowly increase the frequency to 200 MHz (PM3392, PM3394) or 100 MHz (PM3382, PM3384) and verify that the displayed amplitude does not drop below 4.2 divisions.
6 - Switch the frequency of the sine wave signal back to 50 kHz.
7 - Press the ACQUIRE menu key.
8 - Select BW LIMIT 'on' from the ACQUIRE menu.
9 - Slowly increase the frequency to 20 MHz and verify that the vertical deflection has decreased to 4.2 div approximately at 20 MHz.
10 - Switch the bandwidth limiter to 'off'.

Requirements:

The vertical deflection must be 4.2 divisions or more. For the bandwidth limiter the requirement is 4.2 div approximately at 20 MHz.

Repeat the above settings and procedure for CH2, CH3 and CH4. The procedure for CH3 and CH4 in PM3392 must be done via the 10:1 probe instead of the 50Ω cable. Oscilloscope in 1V/div and generator voltage 6 Vpp into 50Ω. Termination resistor directly at generator output.

- Press the DSO key ('DIGITAL MODE' is displayed briefly) and repeat the tests in this chapter for the digital mode. Adjust the MAIN TB TIME/DIV if required.

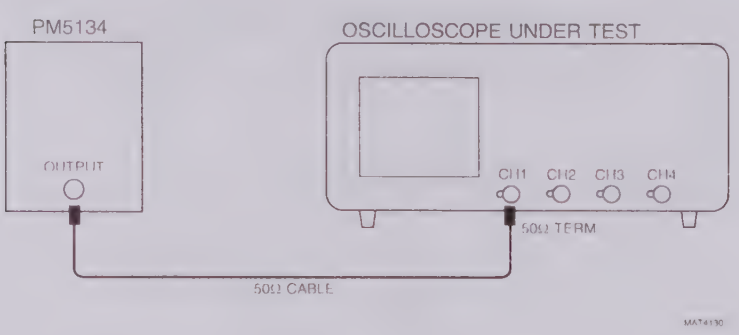
6.3.11 Vertical deflection; low-frequency response

This test verifies the lower transition point of the vertical bandwidth.

Test equipment:

LF sine wave generator (Function generator PM5134 or PM5138)

Test set up:



Settings/procedure:

1 - Apply a 5 kHz sine wave signal of 600 mV (pp into 50Ω) to input CH1, and press the AUTOSET key.
2 - Use an external 50Ω termination. Use the internal termination when available.
3 - Set CH1 to 0.1V/div.
4 - Adjust the input signal to an amplitude of exactly 6 divisions.
5 - Lower the frequency to 10 Hz and verify that the displayed amplitude does not drop below 4.2 divisions.

Requirements:

The vertical deflection must be 4.2 divisions or more.

Repeat the above settings and procedure for CH2, CH3, and CH4.

Press the DSO key ('ANALOG MODE' is displayed briefly) to return to analog mode.

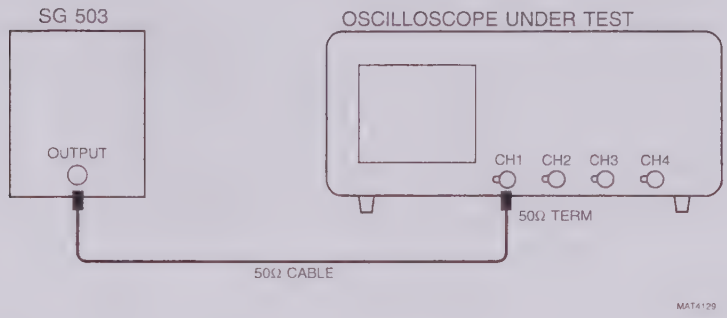
6.3.12 Vertical deflection; dynamic range at 25/50 MHz

The oscilloscope must be capable of displaying signal amplitudes that are larger than the screen. In practice, a low frequency signal with an amplitude equivalent to 24 divisions must be displayed with no distortion.

Test equipment:

Constant amplitude sine wave generator (SG 503)

Test set up:



Settings/procedure:

1 - Apply a 50 MHz (PM3392/94) or 25 MHz (PM3382/84) sine wave signal of 2.4 V(pp into 50Ω) to input CH1 and press the AUTOSET key.
2 - Use a 50Ω termination. Use the internal termination when avaialble.
3 - Set CH1 to 0.1V/div.
4 - Using the CH1 POS control, shift the sine wave vertically over the screen.

Requirements:

Verify that top and bottom of the sine-wave signal of 24 divisions in amplitude can be displayed with no distortion.

Repeat the above settings and procedure for CH2, CH3, and CH4.

6.3.13 Vertical deflection; dynamic range at 100/200 MHz (continuation of 4.3.12)

In this test, the dynamic range of the amplifier is checked at a high frequency.

Settings/procedure:

1 - Apply a 200 MHz (PM3392, PM3394) or 100 MHz (PM3382, PM3384) sine-wave signal of 0.8 V(pp into 50Ω) to input CH1.
2 - Press the AUTOSET key, and set CH1 to 0.1V/div.
3 - Use a 50Ω termination. Use the internal termination when available.
4 - Set the amplitude to exactly 8 divisions.

Requirements:

Verify that the sine wave of 8 divisions in amplitude is displayed with no distortion.

Repeat the above settings and procedure for CH2, CH3, and CH4.

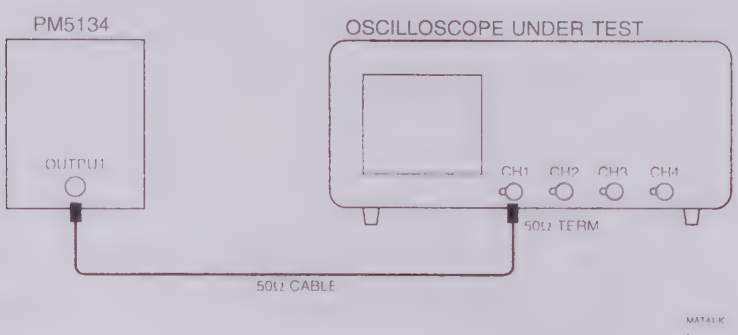
6.3.14 Vertical deflection; position range

The range of the vertical shift is checked with a sine-wave signal of 8 divisions in amplitude.

Test equipment

LF sine wave generator (function generator PM5134 or PM5138)

Test set up:



Settings/procedure:

1 - Apply a 1 kHz sine wave signal with an amplitude of 0.8 V(pp into 50Ω) to input CH1.
2 - Press the AUTOSET key and set CH1 to 0.1V/div.
3 - Use a 50Ω termination. Use the internal termination when available.

Requirements

Turn the CH1 POS control fully clockwise and counterclockwise and verify that top and bottom of the 8 divisions signal can be positioned outside the graticule.

Repeat the above settings and procedure for CH2, CH3, and CH4.

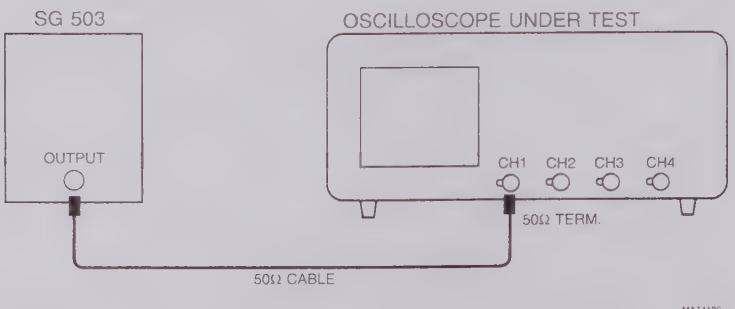
6.3.15 Vertical deflection; crosstalk between channels at 100/200 MHz

At higher frequencies there exists some crosstalk between any two channels. In the following test, crosstalk is verified at a high frequency.

Test equipment:

Constant amplitude sine wave generator (SG 503)

Test set up:



Settings/procedure:

1 - Apply a 200 MHz (PM3392, PM3394) or 100 MHz (PM3382, PM3384) sine-wave signal of 4 V(pp into 50Ω) to input CH1.
2 - Press the AUTOSET key.
3 - Use a 50Ω termination. Use the internal termination when available.
4 - Switch all channels ON.
5 - Set all channels to 0.5V/div.
6 - Adjust the generator to a signal amplitude of 8 div.
7 - Activate the GND function of CH2, CH3, and CH4.

Requirements:

Verify that the displayed amplitude the channels with no input signal applied is less than 0.16 divisions, (better than 50:1).

Repeat the above settings and procedure:
- Input signal applied to CH2. CH1, CH3, and CH4 input GND.
- Input signal applied to CH3. CH1, CH2, and CH4 input GND.
- Input signal applied to CH4. CH1, CH2, and CH3 input GND.
- Press the DSO key ('DIGITAL MODE' is displayed briefly) and repeat the tests in this chapter for the digital mode.
- Press the DSO key ('ANALOG MODE' is displayed briefly) to return to analog mode.

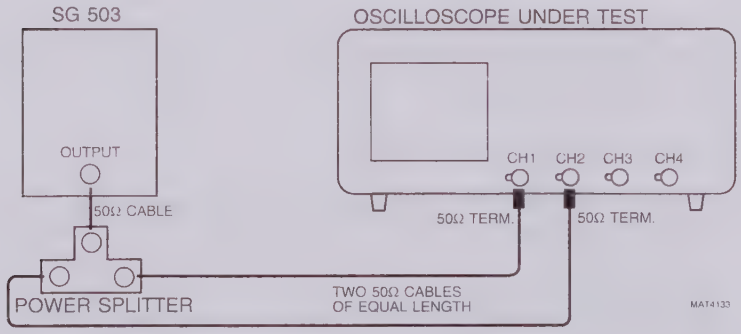
6.3.16 Vertical deflection; common mode rejection ratio at 1 MHz

The common mode rejection ratio (CMRR) is a measure of susceptibility to common mode signals. This susceptibility is verified in this test.

Test equipment:

- HF constant amplitude sine wave generator (SG 503)
- Power splitter

Test set up:



Settings/procedure:

1 - Use a power splitter and two cables of equal length to CH1 and CH2.
Apply a 1 MHz sine-wave signal of 0.6 V(pp into 50Ω) to inputs CH1 and CH2.
2 - Press the AUTOSET key.
3 - Use 50Ω terminations. Use the internal terminations when available.
4 - Set CH1 and CH2 to 0.1V/div and adjust the generator voltage for a deflection of 6 divisions.

5 - Set CH1 and CH2 to DC input coupling.
6 - Press the CH1+CH2 key to activate the 'added' mode.
7 - Press the INV key of CH2; the result is the display of CH1-CH2.
8 - Press the ON keys of CH1 and CH2; this switches CH1 and CH2 off and only the differential signal (CH1 CH2) is now visible.
9 - Readjust the VAR function of CH1 or CH2 for minimum amplitude.

Requirements

1 - Verify that the trace-height of the CH1-CH2 differential signal is less than 0.06 divisions.
2 - Repeat the above settings and procedure for CH3 and CH4 (not required for PM3382-PM3392).

6.3.17 Vertical deflection; common mode rejection ratio at 50 MHz (continuation of 4.3.16)

The common mode rejection ratio (CMRR) indicates the susceptibility to common mode signals at higher frequencies. The susceptibility is verified in this test.

Settings/procedure:

1 - Use a power splitter and two cables of equal length to CH1 and CH2. Apply a sine-wave signal of 50 MHz with an amplitude of 0.6 V(pp into 50Ω) to inputs CH1 and CH2.
2 - Press the AUTOSET key.
3 - Use a 50Ω termination. Use the internal termination when available.
4 - Set CH1 and CH2 to 0.1 V/div and adjust the generator voltage for a deflection of 6 divisions.
5 - Set CH1 and CH2 to DC input coupling.
6 - Press the CH1+CH2 key; to activate the added mode.
7 - Press the INV key of CH2; the result is the display of the differential signal of CH1-CH2.
8 - Press the ON keys of CH1 and CH2; this switches CH1 and CH2 off and only the differential signal of CH1 CH2 display is now visible.
9 - Readjust the VAR function of CH1 or CH2 for minimum amplitude.

Requirements:

1 - Verify that the amplitude of the CH1-CH2 differential signal is less than 0.32 divisions.
2 - Repeat the above settings and procedure for CH3 and CH4 (not required for PM3382/PM3392).

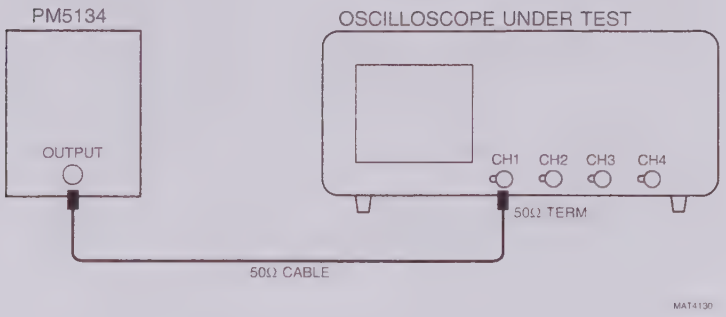
6.3.18 Vertical deflection; LF linearity

The linearity of the vertical amplifier is checked by moving a signal with a fixed amplitude vertically over the entire screen area.

Test equipment

LF square-wave generator (function generator PM5134 or PM5138)

Test set up:



Settings/procedure

1 - Apply a 50 kHz square-wave signal of 200 mV(pp into 50Ω)to input CH1.
2 - Press the AUTOSET key and set CH1 to 0.1V/div.
3 - Use a 50Ω termination. Use the internal termination when available.
4 - Move the square-wave signal to the vertical center of the screen.
5 - Adjust the generator output so that the displayed amplitude is exactly 2 divisions.
6 - Use the CH1 POS control to shift the signal across the central 6 divisions of the screen.

Requirements

1 - Verify that the amplitude in the two upper and lower divisions is between 1.96 ...2.04 divisions (+ or - 2%).
2 - Repeat the above settings and procedure for CH2, CH3 and CH4.
3 - Press the DSO key ('DIGITAL MODE' is displayed briefly) and repeat the check in this chapter for the digital mode. The requirement for the digital mode is a vertical amplitude in the upper and lower screen area between1.94 ... 2.06 divisions (+ or 3%).
4 - Press the DSO key ('ANALOG MODE' is displayed briefly) to return to analog mode.

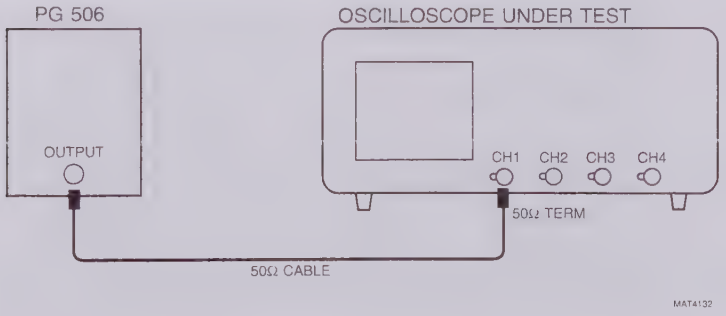
6.3.19 Vertical deflection; visual signal delay

Many applications require that the leading edge of a fast pulse triggering the oscilloscope be made visible. A fixed amount of signal delay is introduced in the vertical channels of this instrument to allow the timebase to start before the triggering leading edge causes vertical deflection to occur.
This delay is verified in the following test.

Test equipment

Square-wave calibration generator (PG 506)

Test set-up



Settings/procedure:

1 - Apply a signal with a fast rise time of less than 1 ns and an amplitude of 0.5V (into 50Ω), and a frequency of 1 MHz, to input CH1. Set the generator in the FAST RISE position.
2 - Press the AUTOSET button and set CH1 to 0.1V/div.
3 - Use a 50Ω termination. Use the internal termination when provided.
4 - Set the MAIN TB TIME/DIV to 50.0 ns/div.
5 - Press the MAGNIFY key and turn the X POS control to display the leading edge.
6 - Turn the TRACE INTENSITY control clockwise for maximum intensity.
7 - Press the TRIGGER menu key.
8 - Select level pp 'off' and 'dc' trigger coupling from the TRIGGER MAIN TB menu.
9 - Adjust TRIGGER LEVEL for a triggered display and maximum visible signal delay

Requirements

Verify that the visible signal delay is at least 15 ns (3 divisions).

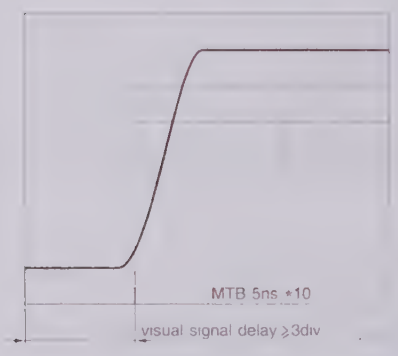


Figure 6.2 Visual signal delay

6.3.20 Vertical deflection; base line instability

In the following test, several adjustments of balance, offset and jump, are checked.

Test equipment

None

Settings/procedure and requirements:

1 - Press the AUTOSET key (no input signal) and set CH1 to 5V/div.
2 - Use the CH1 POS control to position the trace in the vertical middle of the screen.
3 - Press both CH1 AMPL keys simultaneously to select the VARiable mode. The readout changes to 5.00V. The input sensitivity can be adjusted now in very fine steps between 2 mV and 12.5V/div.
4 - Press the 'V' key and verify that the base line jump is not more than 0.2 divisions between 5.00V to 12.5V/div.
5 - Press the 'mV' key and verify that the base line jump is not more than 0.2 divisions between 12.5V/div to 5 mV/div.
6 - Press the ON keys of CH2 and CH1; CH2 is now on and CH1 is off.
7 - Using the CH2 POS control, position the trace in the vertical middle of the screen.
8 - Press both CH2 AMPL keys simultaneously to select the VARiable mode. The readout changes to 5.00V. The input sensitivity can be adjusted now in very fine steps between 2 mV and 12.5V/div.
9 - Press the 'V' key and verify that the base line jump is not more than 0.2 divisions between 5.00V to 12.5V/div.

10 - Press the 'mV' key and verify that the base line jump does not 0.2 divisions between 12.5V/div to 5 mV/div.
11 - Press the INV key repeatedly and verify that the base line jump is not more than 0.2 divisions.

For the PM3394 and PM3384 repeat the above procedure for CH3 and CH4. The CH3 settings are equal to those of CH1; the CH4 settings are equal to CH2.

For the PM3392 and PM3382 the following steps are required to check CH3 and CH4:

1 - Press the ON keys of CH3 and CH2; CH3 is now on and CH2 is off.
2 - Use the CH3 POS control to position the trace in the vertical center of the screen.
3 - Press the CH3 AMPL key repeatedly and verify that the base line jump does not exceed 0.2 divisions.
4 - Press the ON keys of CH4 and CH3; CH4 is now on and CH3 is off.
5 - Using the CH4 POS control, position the trace in the vertical center of the screen.
6 - Press the CH4 AMPL key repeatedly and verify that the base line jump does not exceed 0.2 divisions.
7 - Press the INV key repeatedly and verify that the base line jump does not exceed 0.2 divisions.

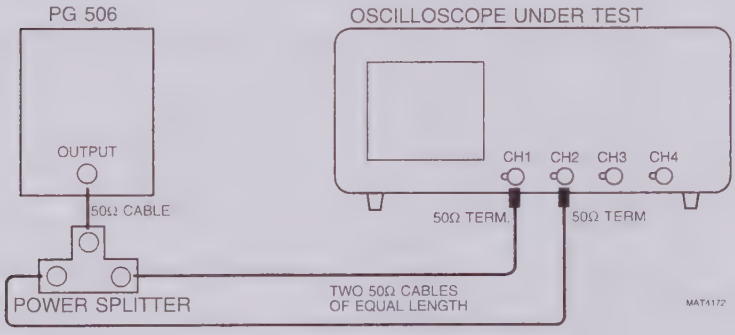
6.3.21 Delay difference between vertical channels

The delay difference between CH1, CH2, CH3, and CH4 is checked here.

Test equipment:

Square wave calibration generator (PG 506)
Power splitter

Test set up:



Settings/procedure PM3392, PM3394, PM3382, PM3384:

1 - Apply a square-wave signal with a fast rise time of less than 1 ns, and an amplitude of 0.5V (into 50Ω), with a frequency of 1 MHz, to inputs CH1 and CH2. The generator must be set in the FAST RISE position.
Use a power splitter and two cables of equal length to CH1 and CH2.
2 - Press the AUTOSET key.
3 - Use 50Ω terminations. Use the internal terminations when available.
4 - Set CH1 and CH2 to 0.1V/div and input coupling to DC.
5 - Press the MAGNIFY keys and set the MAIN TB TIME/DIV to 2.00 ns/div (PM3392, PM3394) or to 5.00 ns/div (PM3382, PM3384).
6 - Press the TRIGGER menu key.
7 - Select level-pp 'off' and 'dc' trigger coupling from the related menu.
8 - Press the TB MODE menu key.

9 - Select 'trig' from the related menu.
10 - Adjust TRIGGER LEVEL for a triggered display of the leading edge.
11 - Using the X POS control, position the leading edges of the signals in the horizontal center of the screen.
12 - Using both CH1 and CH2 POS controls, adjust the vertical position of each trace between the dotted 0% and 100% lines. The signals appear to be superimposed.

Requirements

Verify that the delay difference between the two displayed signals is less than 0.25 ns. This equals 0.13 divisions in PM3392 and PM3394 or 0.05 divisions in PM3382 and PM3384.

Repeat the above settings and procedure for CH3 and CH4.

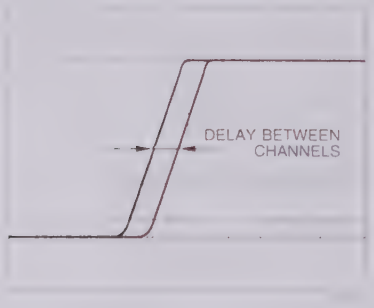


Figure 6.3 Delay difference ≤ 0.13 div in PM3392/94 or ≤ 0.05 div in PM3382/84.

Settings/procedure PM3392 and PM3382:

1 - Apply a fast rise time (≤1 ns) signal of 0.5V (into 50Ω), frequency 1 MHz, to inputs CH1 and CH3. Generator in position FAST RISE.
Use a power splitter and two cables of equal length to CH1 and CH3.
2 - Press the AUTOSET key.
3 - Use 50Ω terminations.
4 - Set CH1 and CH3 to 0.1V/div and input coupling to DC.
5 - Press MAGNIFY key and set MAIN TB TIME/DIV to 2.00 ns (PM3392) or to 5.00 ns (PM3382).
6 - Press the TRIGGER menu key.
7 - Select level-pp 'off' and 'dc' trigger coupling from the related menu.
8 - Press the TB MODE menu key.
9 - Select 'trig' from the related menu.
10 - Adjust TRIGGER LEVEL for a triggered display of the leading edge.
11 - Position the rising edges of the signals in the horizontal center of the screen, by means of the X POS control.
12 - Adjust the two traces between the dotted lines 0% and 100% by means of the CH1 and CH3 POS controls so that both signals cover each other.

Requirements:

Verify that the delay difference between the two displayed signals is less than 0.5 ns: this equals 0.25 divisions in PM3392 or 0.1 divisions in PM3382.

Repeat settings/procedure for CH1 and CH4.

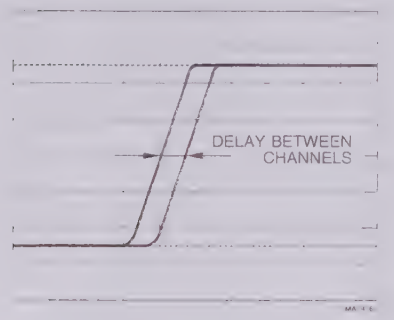


Figure 6.4 Delay difference ≤0.25 div in PM3392 or ≤0.1 div in PM3382.

- Press the DSO key ('DIGITAL MODE' is displayed briefly) and repeat the tests in this chapter for the digital mode. In digital mode, it is not necessary to activate the MAGNIFY function since the timebase ranges up to 2.00 ns/division (PM3392/3394) or 5.00 ns/division (PM3382/3384).
- Press the DSO key ('ANALOG MODE' is displayed briefly) to return to analog mode.

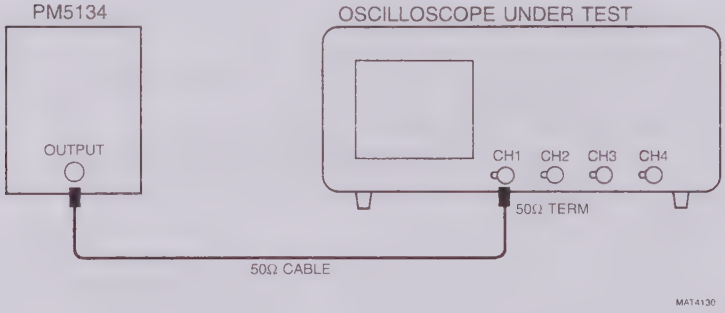
6.3.22 Horizontal deflection; display modes and trace separation

The correct working of main timebase (MAIN TB), delayed timebase (DELAYED TIME BASE) and the trace separation is checked.

Test equipment:

LF sine wave generator (function generator, PM5134 or PM1538)

Test set-up:



Settings/procedure and requirements:

1 - Apply a 2 kHz sine-wave signal of 400 mV(pp into 50Ω) to input CH1.
2 - Press the AUTOSET key and set CH1 to 0.1V/div.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature.
4 - Adjust the generator signal to a trace height of 4 divisions.
5 - Set MAIN TB to 500 µs.
6 - Press the MODE menu key.
7 - Set DEL'D TB to 'on' in the DELAYED TIMEBASE menu.

8 - Set MAIN TB to 'on' in the DELAYED TIMEBASE menu.
9 - Set the DELAYED TIMEBASE to 50.0 µs.
10 - Turn the DELAY control (in the DELAYED TIMEBASE section), and verify that the intensified part can be shifted horizontally along the MAIN TB display.
11 - Operate the TRACK control and check that the DEL'D TB and MAIN TB display can be shifted so that they do not cover each other.

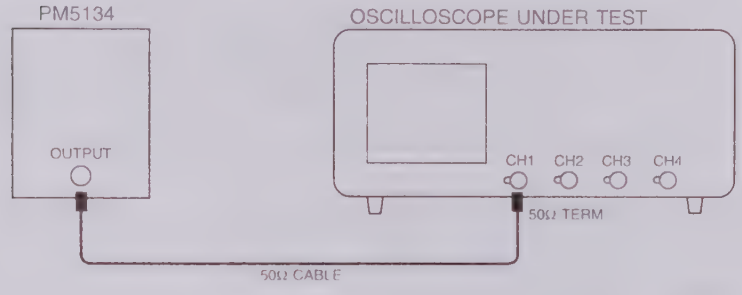
6.3.23 Horizontal deflection; X deflection

The correct working of the X Y mode (X-DEFL 'on') is tested.

Test equipment:

LF sine wave generator (function generator, PM5134 or PM5138)

Test set-up:



Settings/procedure:

1 - Apply a 2 kHz sine-wave signal of 800 mV(pp into 50Ω) to input CH1.
2 - Press the AUTOSET key and set CH1 to 0.1V/div.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature.
4 - Adjust the generator signal to a trace height of 8 divisions.
5 - Press the DISPLAY menu key.
6 - Press the X-DEFL softkey in the DISPLAY menu.
7 - Select 'on' and 'ch1' as X-SOURCE in the X-DEFL menu.
8 - Use the CH1 POS and X POS controls to obtain the display shown in the figure below

Requirements:

Verify that a line with an angle of 45° is displayed.

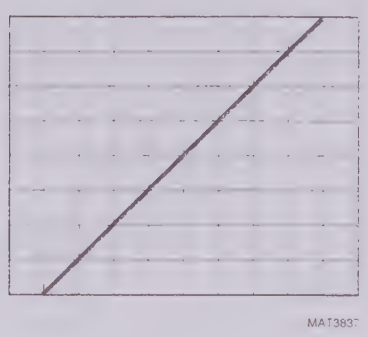


Figure 6.5 X deflection

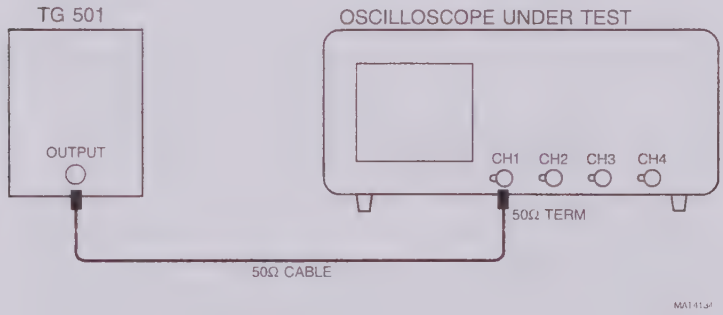
6.3.24 Horizontal deflection; MAIN TB deflection coefficients

The deflection coefficients of the main timebase generator (MAIN TB) are verified by means of a calibration signal.

Test equipment:

Time marker generator (TG 501)

Test set-up:



Settings/procedure:

1 - Apply a 50.0 ns time marker signal to input CH1.
2 - Press the AUTOSET key.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature.
4 - Press the TRIGGER menu key.
5 - Select level-pp 'off' and 'dc' from the TRIGGER MAIN TB menu.
6 - Press the TB MODE menu key.
7 - Select 'trig' from the TB MODE menu.
8 - Adjust the TRIGGER LEVEL control for a correctly triggered display.
9 - Verify the deflection coefficients of MAIN TB with MAGNIFY off (*1) and MAGNIFY on (*10) according to the requirements in the tables. Use the deflection error facility of the time marker generator.

Note:
- *Error limits must be measured between the 2nd and the 10th graticule line (there are 11 graticule lines). These are the central 8 divisions.*
- *With MAGNIFY on (*10), the central 10 divisions of the expanded 100 divisions of MAIN TB are measured.*
- *Only the timebase positions essential for instrument accuracy are checked.*
- *Press the DSO key ('DIGITAL MODE' is displayed briefly) to perform the tests for the digital mode. Press the TEXT OFF key for full visibility of the time marker pulses in the central 8 divisions.*
- *Press the DSO key ('ANALOG MODE'is displayed briefly) to return to analog mode.*

Requirements for analog mode MAGNIFY off (*1):

MAIN TB setting	Marker pulse	Max. error
20.0 ns (PM3392/94)	20 ns	1.8%
100 ns	0.1 µs	1.8%
500 ns	0.5 µs	1.8%
1.00 µs	1 µs	1.8%
5.00 µs	5 µs	1.8%
20.0 µs	20 µs	1.8%
500 µs	0.5 ms	1.8%
1.00 ms	1 ms	1.8%
10.0 ms	10 ms	1.8%

Requirements for analog mode MAGNIFY on (*10):

MAIN TB setting	Marker pulse	Max. error
2.00 ns (PM3392/94)	2 ns	3.3%
5.00 ns	5 ns	3.3%
10.0 ns	10 ns	2.3%
100 ns	0.1 µs	2.3%

Requirements for digital mode:

MAIN TB setting	Marker pulse	Max. error
2.00 ns (PM3392/94)	2 ns	1.8%
5.00 ns (PM3382/84)	5 ns	1.8%
250 ns	0.5 µs	1.3%
500 ns	0.5 µs	1.3%
20.0 ms	20 ms	1.3%
1.00 s	1 s	1.3%

Check for an undistorted display of the time marker pulses. Timing accuracy should not show a noticeable error. In the MAIN TB setting 250 ns/division, the interval between successive time marker pulses should be 2 div.'

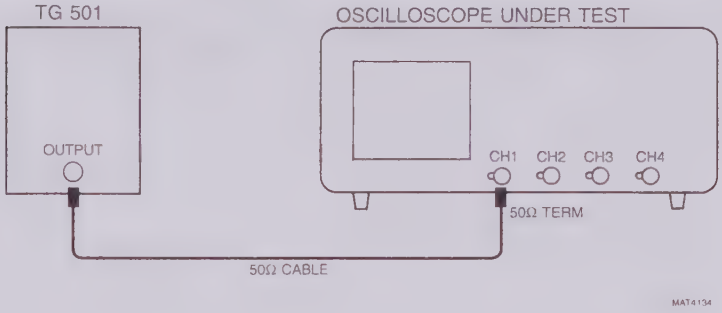
6.3.25 Horizontal deflection; VARiable mode accuracy MAIN TB.

The horizontal MAIN TB deflection coefficients can be varied in steps such as done in 4.3.24. A range of much finer steps can also be selected. Here, the accuracy of this range is checked.

Test equipment:

Time marker generator (TG 501)

Test set-up:



Settings/procedure:

1 - Apply a 5 us time marker signal to input CH1.
2 - Press the AUTOSET key.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature.
4 - Press the TRIGGER menu key.
5 - Select level-pp 'off' and trigger coupling 'dc' from the TRIGGER MAIN TB menu.
6 - Adjust the TRIGGER LEVEL control for a correctly triggered display.
7 - Set the MAIN TB TIME/DIV to 5.00 us.
8 - Select the MTB VARiable mode by pressing both MAIN TB TIME/DIV keys at a time: the message; 'VARIABLE TIMEBASE' is displayed briefly.
9 - Press the 'ns' key and adjust the readout to 2.50 us.

Requirements:

Verify that the horizontal distance between the time markers equals 2 divisions. Use the X POS control to align the marker pulses with the graticule. Now check (across the central 8 divisions) if the timebase accuracy is ±2.8%: make use of the deflection error facility of the time marker generator to check this.

6.3.26 Time cursor accuracy (continuation of 4.3.25)

This test verifies the accuracy of the time cursors.

Settings/procedure:

- Switch the MAIN TB VARiable mode off by pressing both MAIN TB TIME/DIV keys at a time. The message 'DISCRETE TIMEBASE'.
- Select 5.00 µs/division for the MAIN TB.
- Switch off the deflection error facility of the time marker generator.
- Press the CURSORS menu key.
- Select 'on' and time cursors (//) from the CURSORS menu.
- Select Δ T in the READOUT menu.

Requirements:

- Position one cursor line exactly on the 2nd time marker on the screen and the other cursor on the 10th time marker. The distance between both cursors is now 8 time marker intervals. Check for a cursor readout between 39.5 and 40.5 µs.
- Press the DSO key ('DIGITAL MODE' is displayed briefly) and repeat the check in this chapter for the digital mode. Press the TEXT OFF key to have the full screen width available to display the time markers.
- Press the DSO key ('ANALOG MODE' is displayed briefly) to return to analog mode.

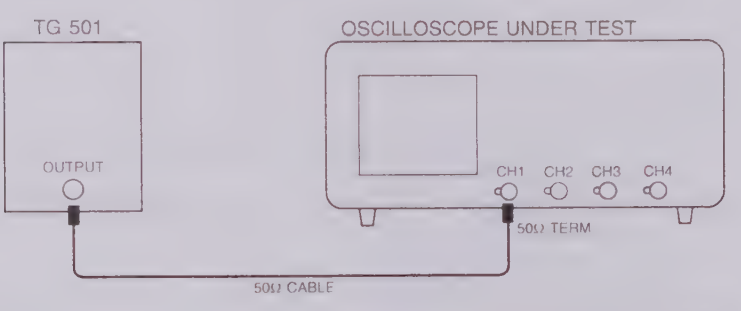
6.3.27 Horizontal deflection; DELAYED TIME BASE deflection coefficients

The deflection coefficients of the delayed timebase generator (DEL'D TB) are verified by means of a calibration signal.

Test equipment:

Time marker generator (TG 501)

Test set-up:



Settings/procedure:

1 - Apply a 0.5 ms time marker signal to input CH1.
2 - Press the AUTOSET key.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature.
4 - Press the TRIGGER menu key.
5 - Select level-pp 'off' and 'dc' trigger coupling from the TRIGGER MAIN TB menu.
6 - Press the TB MODE menu key and select 'trig' from the related menu.
7 - Adjust TRIGGER LEVEL for a correctly triggered display.
8 - Set the trace height to about 4 divisions.
9 - Press the MODE menu key and select DEL'D TB 'on' and MAIN TB 'on' from the related menu .
10 - Set MAIN TB to 500 µs and DELAYED TIME BASE to 500 µs.
11 - Use the POS control (in the DELAYED TIMEBASE SECTION to set the time delay to about 0 seconds.
12 - Adjust the vertical position of the MAIN TB display with the CH1 POS control in the top half of the viewing area.
13 - Adjust the vertical position of the DELAYED TIMEBASE display with the TRACK control.
14 - Verify the DELAYED TIMEBASE deflection coefficients with MAGNIFY off (*1) and MAGNIFY on (*10) according to the requirements in the tables. Use the deflection error facility of the time marker generator.

Note:
- *Error limits must be measured between the 2nd and the 10th graticule line (there are 11 graticule lines). These are the central 8 divisions.*
- *With MAGNIFY on (*10), the central 10 divisions of the expanded 100 divisions of DEL'D TB are measured.*
- *Only the timebase positions that are essential for instrument accuracy are checked.*
- *DEL'D TB TIME/DIV is electrically coupled to MAIN TB TIME/DIV; to check the settings in the table press only the MAIN TB TIME/DIV VAR keys.*

Requirements for analog mode MAGNIFY off (*1):

DEL'D TB setting	MAIN TB setting	Marker pulse	Max. error
500 µs	500 µs	0.5 ms	1.8%
20.0 µs	20.0 µs	20 µs	1.8%
5.00 µs	5.00 µs	5 µs	1.8%
1.00 µs	1.00 µs	1 µs	1.8%
500 ns	500 ns	0.5 µs	1.8%
100 ns	100 ns	0.1 µs	1.8%
50.0 ns	50.0 ns	50 ns	1.8%
20.0 ns (PM3392/94)	20.0 ns	20 ns	1.8%

Requirements for analog mode MAGNIFY on (*10):

DEL'D TB setting	MAIN TB setting	Marker pulse	Max. error
100 ns	100 ns	0.1 µs	2.3%
10.0 ns	10.0 ns	10 ns	2.3%
5.00 ns	5.00 ns	5 ns	3.3%
2.00 ns (PM3392/94)	2.00 ns	2 ns	3.3%

6.3.28 Horizontal deflection; delay time multiplier

In this test the minimum and maximum delay time is checked.

Test equipment:

None

Settings/procedure and requirements:

1 - Press the AUTOSET key.
2 - Press the MODE menu key and select DEL'D TB 'on' and MAIN TB 'on' from the appropriate menu .
3 - Set MAIN TB to 500 ns.
4 - Set DEL'D TB to 50.0 ns.
5 - Separate the MAIN TB and DEL'D TB traces with the TRACK control.
6 - Adjust the delay time to 500.0 ns using of the DELAY control (in the DELAYED TIMEBASE section).
7 - Adjust the start of the MAIN TB display exactly on the first graticule line by using the X POS control.
8 - Verify that the difference between the start of MAIN TB and the start of the intensified part is between 0.9 to 1.1 divisions.
9 - Adjust the delay time to 5.00 µs with the POS control (in the DELAYED TIMEBASE section).
10 - Verify that the difference between the start of MAIN TB and the start of the intensified part is between 9.9 and 10.1 divisions.

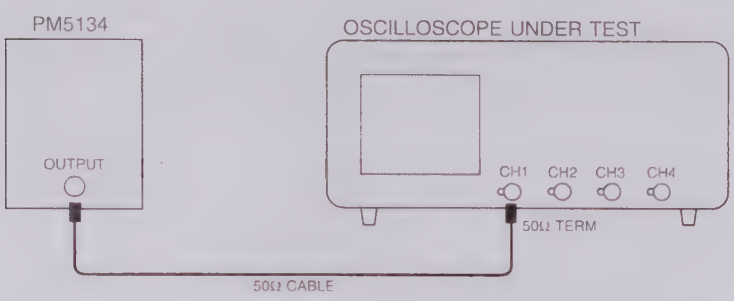
6.3.29 Horizontal deflection; delayed timebase jitter

There is a certain instability in the starting point, the so called jitter, of the DEL'D TB. The maximum allowed jitter is checked in this test.

Test equipment:

LF sine wave generator (function generator PM5134 or PM5138)

Test set-up:



Settings/procedure:

1 - Apply a 1 MHz sine-wave signal of 120 mV(pp into 50Ω) to input CH1.
2 - Press the AUTOSET key and set for a trace-height of 6 divisions.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature.
4 - Press the MODE menu key and select DEL'D TB 'on' and MAIN TB 'on' from the appropriate menu.
5 - Set MAIN TB to 500 µs.
6 - Set DEL'D TB to 500 ns.
7 - Adjust the delay time to 5.00 ms using the POS control (in the DELAYED TIMEBASE section).
8 - Switch the MAIN TB display to 'off' in the DELAYED TIMEBASE menu; only the DEL'D TB is displayed now.

Requirements:

Verify that the jitter of the DEL'D TB is not more than 0.4 divisions (1 part per 25000).

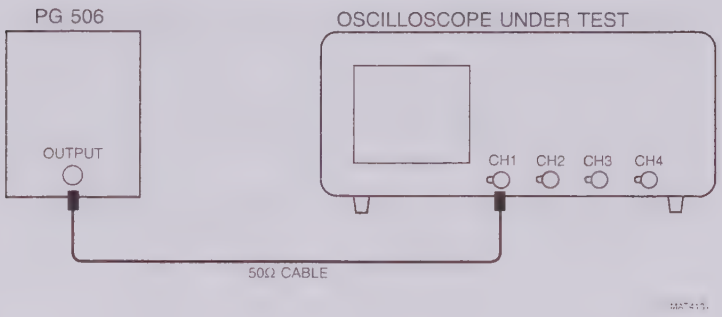
6.3.30 Horizontal deflection; X deflection coefficient via CH1

The amplification of the horizontal amplifier via the vertical input amplifier is checked.

Test equipment:

Square-wave calibration generator (PG 506)

Test set-up:



Settings/procedure:

1 - Apply a 1 kHz square-wave signal of 0.1V to input CH1. Generator in 'STD AMPL' mode and output not terminated into 50Ω ('LZ' must not appear in lower part of viewing area).
2 - Press the AUTOSET key.
3 - Set CH1 to 20 mV and DC coupled input.
4 - Press the DISPLAY menu key.
5 - Press X-DEFL softkey.
6 - Select 'on' and 'ch1' from the X-DEFL menu.
7 - Press the CH2 ON key and then the CH1 ON key; the result is that CH2 is on and CH1 is off.

Requirements:

Verify that two dots with a horizontal distance of 4.7 ... 5.3 divisions are displayed.

6.3.31 Horizontal deflection; X deflection coefficient via 'line'

The amplification of the horizontal amplifier via the line trigger signal is checked. Do this test only when 220V power is available.

Test equipment:

None

Settings/procedure:

1 - Press the AUTOSET key.
2 - Press the DISPLAY menu key.
3 - Press X-DEFL softkey.
4 - Select 'on' and 'line' from the X-DEFL menu.

Requirements:

Verify that a horizontal line of 4.3 to 7.7 divisions is displayed when the line voltage is 220V (rms).

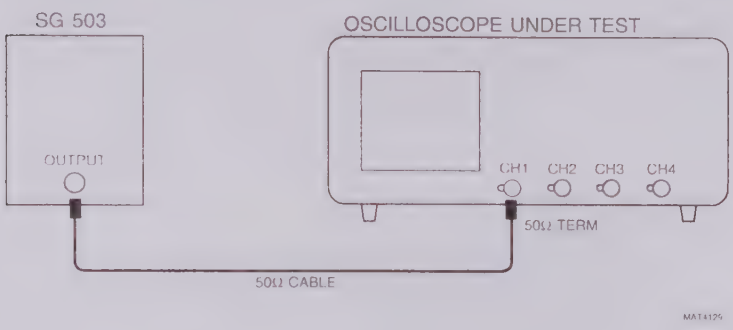
6.3.32 Horizontal deflection; high frequency response

In this test, the bandwidth of the horizontal amplifier is checked.

Test equipment:

Constant amplitude sine wave generator (SG 503).

Test set-up:



Settings/procedure:

1 - Apply a 50 kHz sine-wave signal of 30 mV(pp into 50Ω) to input CH1.
2 - Press the AUTOSET key and set CH1 to 5 mV.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature ('LZ' must be visible in lower part of viewing area).
4 - Press the DISPLAY menu key and then press the X-DEFL softkey.
5 - Select 'on' and 'ch1' from the X-DEFL menu.
6 - Press the CH2 ON key and then the CH1 ON key: the result is that CH2 is on and CH1 off.
7 - Adjust the input voltage for exactly 6 divisions horizontal deflection.
8 - Increase the input frequency up to 2 MHz.

Requirements:

Verify that the trace width is at least 4.2 divisions over the complete bandwidth range.

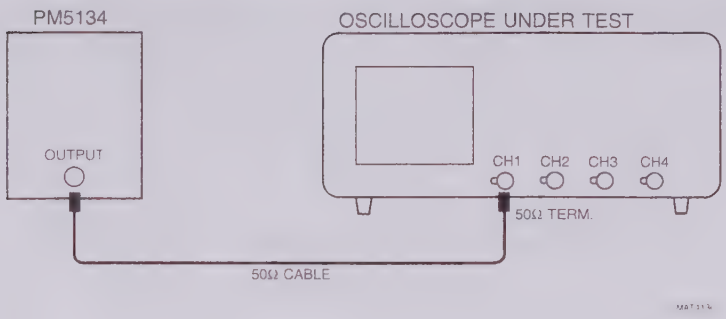
6.3.33 Maximum phase shift between horizontal and vertical deflection

There will be a certain phase shift between the horizontal and vertical amplifier. The value of this shift is measured here.

Test equipment:

LF sine wave generator (function generator, PM 5134 or PM 5138)

Test set-up:



Settings/procedure:

1 - Apply a 2 kHz sine-wave signal of 1.2 V(pp into 50Ω) to CH1.
2 - Press the AUTOSET key.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature.
4 - Adjust the generator to a trace height of exactly 6 divisions.
5 - Press the DISPLAY menu key and then press the X-DEFL softkey.
6 - Select 'on' and 'ch1' from the X-DEFL menu.
7 - Increase the input frequency to 100 kHz.

Requirements:

Verify that the phase shift is less than 3°, ≤0.32 div, see figure).

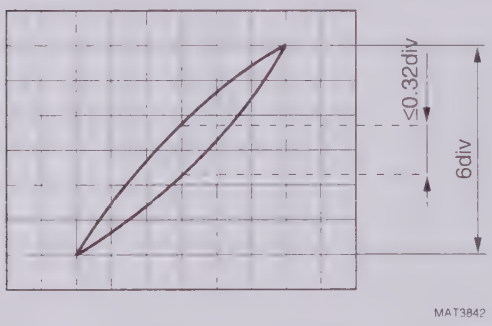


Figure 6.6 Phase shift between horizontal and vertical channel

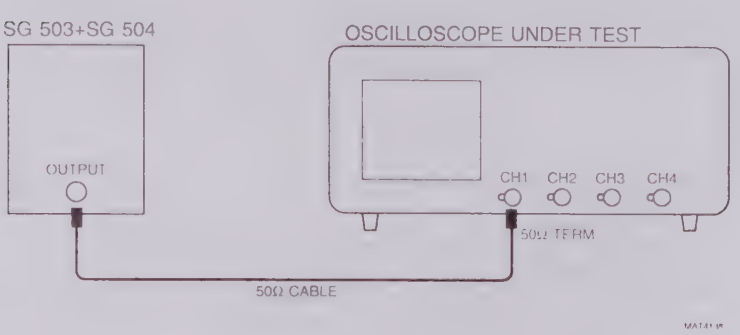
6.3.34 MAIN TB triggering PM3392/3394; trigger sensitivity via CH1, CH2, CH3 and CH4

The trigger sensitivity depends on the amplitude and frequency of the trigger signal. In this test the main timebase trigger sensitivity via the CH1, CH2, CH3 and CH4 inputs is checked.

Test equipment:

Constant amplitude sine wave generators (SG 503 + SG 504)

Test set-up:



Settings/procedure and requirements:

1 - Apply a 100 MHz sine-wave signal of 1 V(pp into 50Ω) from the SG 503 to input CH1.
2 - Press the AUTOSET key and set CH1 to 0.5V/div.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature.
4 - Set the input coupling of CH1 to DC and POSition the signal in the vertical center of screen.
5 - Select 'trig' from in the menu under the TB MODE mode key.
6 - Press the TRIGGER menu key and select level-pp 'off' and 'dc' trigger coupling from the TRIGGER MAIN TB menu
7 - Adjust TRIGGER LEVEL for a correctly triggered display.
8 - Decrease the amplitude of the input signal.
9 - Verify that the signal is well-triggered at amplitudes of 0.6 divisions and more.
10 - Decrease the input frequency to 50 kHz.
11 - Verify that the signal stays well-triggered at amplitudes of 0.6 divisions and more.
12 - Increase the input frequency to 200 MHz.
13 - Increase the input voltage to 1.2 division.
14 - Turn TRIGGER LEVEL.
15 - Verify that the signal is well-triggered at amplitudes of 1.2 division and more.
16 - Apply a 300 MHz sine-wave signal of 2V (pp into 50Ω) from the SG 504 to input CH1.
17 - Adjust the input voltage to 2 divisions. Signal must be in vertical center of screen.
18 - Verify that the signal is well-triggered at amplitudes of 2 divisions and more; adjust TRIGGER LEVEL when necessary.

- Repeat the procedure for CH2, CH3 and CH4 for the frequencies 50 kHz (0.6 division input signal) and 300 MHz (2 division input signal)
- Press the DSO key ('DIGITAL MODE' is displayed briefly), then repeat the tests in this chapter for the digital mode.
- Press the DSO key ('ANALOG MODE' is displayed briefly) to return to analog mode.

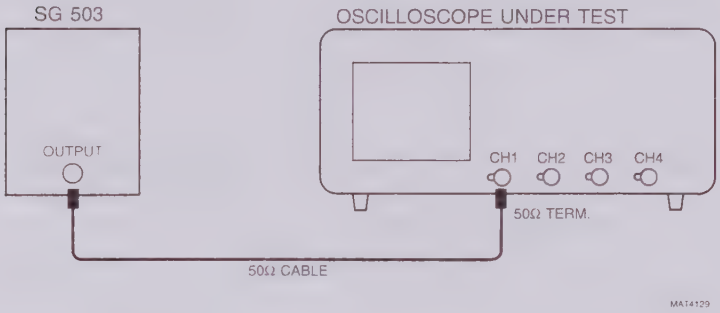
6.3.35 MAIN TB triggering PM3382/3384; trigger sensitivity via CH1, CH2, CH3 and CH4

The trigger sensitivity depends on the amplitude and frequency of the trigger signal. In this test the main timebase trigger sensitivity via the CH1, CH2, CH3 and CH4 inputs is checked.

Test equipment:

Constant amplitude sine wave generator (SG 503)

Test set-up:



Settings/procedure and requirements:

1 - Apply a 50 MHz sine-wave signal of 1 V(pp into 50Ω) to input CH1.
2 - Press the AUTOSET key and set CH1 to 0.5V/div.
3 - Use a 50Ω termination.
4 - Set the input coupling of CH1 to DC and POSition the signal in the vertical center of screen.
5 - Select 'trig' from the menu under the TB MODE menu key.
6 - Press the TRIGGER menu key and select level-pp 'off' and 'dc' trigger coupling from the TRIGGER MAIN TB menu
7 - Adjust TRIGGER LEVEL for a correctly triggered display.
8 - Decrease the amplitude of the input signal.
9 - Verify that the signal is well-triggered at amplitudes of 0.6 divisions and more.
10 - Decrease the input frequency to 50 kHz.
11 - Verify that the signal stays well-triggered at amplitudes of 0.6 divisions and more.
12 - Increase the input frequency to 100 MHz.
13 - Increase the input voltage to 1.2 division.
14 - Turn TRIGGER LEVEL.
15 - Verify that the signal is well-triggered at amplitudes of 1.2 division and more.
16 - Increase the input frequency to 200 MHz. Signal must be in vertical center of screen.
17 - Adjust the input voltage to 2 divisions.
18 - Verify that the signal is well-triggered at amplitudes of 2 divisions and more; adjust TRIGGER LEVEL when necessary.

- Repeat the procedure for CH2, CH3 and CH4 for the frequencies 50 kHz (0.6 division input signal) and 200 MHz (2 division input signal)
- Press the DSO key ('DIGITAL MODE' is displayed briefly) and repeat the tests in this chapter for the digital mode.
- Press the DSO key ('ANALOG MODE is displayed briefly for some seconds) to return to analog mode.

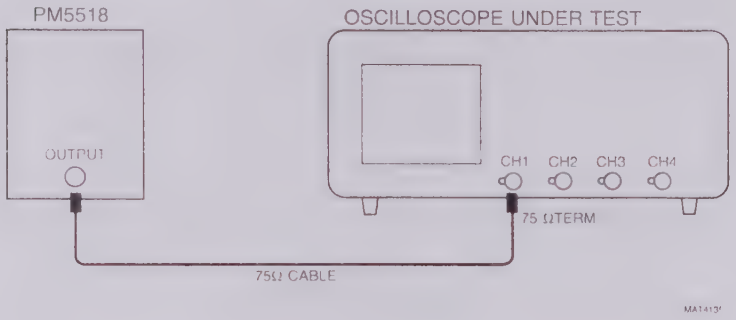
6.3.36 MAIN TB/DEL'D TB triggering; trigger sensitivity TVL-TVF

This test checks the trigger sensitivity for television line- and field synchronization pulses.

Test equipment:

TV pattern generator with video output (PM 5518)

Test set-up:



Note: the number a various tests to be performed is numerous. Therefore it is recommended only to check the tv system(s) as used in your country. The number of tests is also limited by the available TV pattern generator.

1 - Apply a video signal to input CH1 with an amplitude of about 1V synchronization pulse amplitude; use a 75Ω termination instead of internal or external 50Ω.
2 - Press the AUTOSET key.
3 - Press menu key TRIGGER and select 'tv' in the related menu.
4 - Select field 1 or field 2 in the menu.
5 - Select a line number (e.g. 25) by means of the TRACK control.
6 - Select pos or neg (depending on the available TV pattern generator).
7 - Select in the VIDEO SYSTEM submenu hdtv, ntsc, pal or secam (depending on the available TV pattern generator). The maximum number of lines for hdtv can be selected if hdtv is active.

Requirements:

Decrease the amplitude of the input signal and verify that the signal is well-triggered on the tv pulses, at sync pulse amplitudes of 0.7 divisions and more.

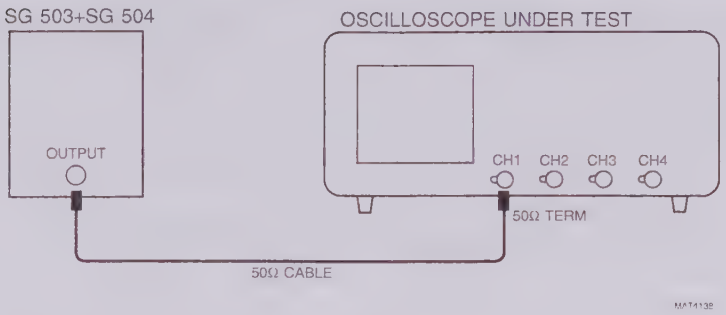
6.3.37 DEL'D TB triggering PM3392/3394; trigger sensitivity via CH1, CH2, CH3 and CH4

The trigger sensitivity depends on the amplitude and frequency of the trigger signal. In this test the main timebase trigger sensitivity via the CH1, CH2, CH3 and CH4 inputs is checked.

Test equipment:

Constant amplitude sine wave generators (SG 503 + SG 504)

Test set-up:



Settings/procedure and requirements:

1 - Apply a 100 MHz sine-wave signal of 1 V(pp into 50Ω) from the SG 503 to input CH1.
2 - Press the AUTOSET key and set CH1 to 0.5V/div.
3 - Use a 50Ω termination. For instruments with switchable 50Ω input impedance it is recommended to make use of this feature.
4 - Set the input coupling of CH1 to DC and POSition the signal in the vertical center of screen.
5 - Select 'trig' from the menu under the TB MODE menu key.
6 - Press the TRIGGER menu key and select level-pp 'off' and 'dc' trigger coupling from the TRIGGER MAIN TB menu.
7 - Adjust TRIGGER LEVEL for a correctly triggered display.
8 - Press the MODE menu key and select DEL'D TB 'on' and MAIN TB 'on' in the related menu.
9 - Set MAIN TB to 200 ns/division and DELAYED TIMEBASE to 20.0 ns/division.
10 - Adjust the DELAY control in the DELAYED TIMEBASE section to a delay time of 1.000 µs.
11 - Select 'trig'd' and 'dc' coupling from the DELAYED TIME BASE menu, and press the front panel key TRIG1. Or TRIG2 (if CH2 on), TRIG3 (if CH3 on), TRIG4 (if CH4 on).
12 - Adjust the DEL'D TB trigger level via the Δ control for a well- triggered signal (intensified part must be visible).
13 - Operate the TRACK control to separate MAIN TB and DEL'D TB for clearly visible displays.
14 - Decrease the amplitude of the input signal.
15 - Verify that the DEL'D TB is well triggered at signal amplitudes of 0.6 divisions and more.
16 - Decrease the input frequency to 50 kHz. Set the MAIN TB to 50.0 µs/division and DEL'D TB to 20.0 µs/division.
17 - Verify that the DEL'D TB stays well triggered at signal amplitudes of 0.6 divisions and more.
18 - Increase the input frequency to 200 MHz.
19 - Increase the input voltage to 1.2 division.
20 - Operate the Δ control (controls DEL'D TB trigger level).
21 - Verify that the DEL'D TB is well triggered at all amplitudes of 1.2 divisions or more.
22 - Apply a 300 MHz sine-wave signal of 2V (pp into 50 ohm) from the SG504 generator to input CH1.
23 - Adjust the input voltage to 2 divisions. Signal must be in vertical center of screen.
24 - Verify that the DEL'D TB is well triggered at signal amplitudes of 2 divisions and more: adjust the Δ control (DEL'D TB trigger level) if necessary.

- Repeat the procedure for CH2, CH3 and CH4 for the frequencies 50 kHz (0.6 division input signal) and 300 MHz (2 division input signal)
- Press the DSO key ('DIGITAL MODE' is displayed briefly) and repeat the tests in this chapter for the digital mode.
- Then press the DSO key ('ANALOG MODE' is displayed briefly) to return to analog mode.

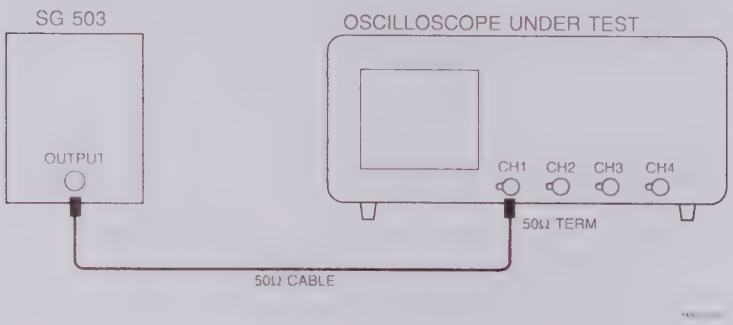
6.3.38 DEL'D TB triggering PM3382/3384; trigger sensitivity via CH1, CH2, CH3 and CH4

The trigger sensitivity depends on the amplitude and frequency of the trigger signal. In this test the main timebase trigger sensitivity via the CH1, CH2, CH3 and CH4 inputs is checked.

Test equipment:

Constant amplitude sine wave generator (SG 503)

Test set-up:



Settings/procedure and requirements:

1 - Apply a 50 MHz sine-wave signal of 1 V(pp into 50Ω) from the SG 503 to input CH1.
2 - Press the AUTOSET key and set CH1 to 0.5V/div.
3 - Use a 50Ω termination.
4 - Set the input coupling of CH1 to DC and POSition the signal in the vertical center of screen.
5 - Select 'trig' from the menu under the TB MODE menu key.
6 - Press the TRIGGER menu key and select level-pp 'off' and 'dc' trigger coupling from the TRIGGER MAIN TB menu
7 - Adjust TRIGGER LEVEL for a correctly triggered display.
8 - Press the MODE menu key and select DEL'D TB 'on' and MAIN TB 'on' from the related menu.
9 - Set the MAIN TB to 200 ns/division and DELAYED TIMEBASE to 50.0 ns/division.
10 - Adjust the DELAY control in the DELAYED TIMEBASE section to a delay time of 1.000 µs.
11 - Select 'trig'd' and 'dc' coupling from the DELAYED TIMEBASE menu and press the front panel key TRIG1. Or TRIG2 (if CH2 on), TRIG3 (if CH3 on), TRIG4 (if CH4 on).
12 - Adjust the DEL'D TB trigger level via the Λ control for a well- triggered signal (intensified part must be visible).
13 - Operate the TRACK control to separate the MAIN TB and DEL'D TB for clearly visible displays.
14 - Decrease the amplitude of the input signal.
15 - Verify that the DEL'D TB is well triggered at signal amplitudes of 0.6 divisions and more.
16 - Decrease the input frequency to 50 kHz. Set the MAIN TB to 50.0 µs/division and DEL'D TB to 20.0 µs/division.
17 - Verify that the DEL'D TB stays well triggered at signal amplitudes of 0.6 divisions and more.
18 - Increase the input frequency to 100 MHz.
19 - Increase the input voltage to 1.2 division.
20 - Operate the Δ control (controls the DEL'D TB trigger level).
21 - Verify that the DEL'D TB is well triggered at all amplitudes of 1.2 division or more.
22 - Increase the input frequency to 200 MHz.
23 - Adjust the input voltage to 2 divisions.
24 - Verify that the DEL'D TB is well-triggered at signal amplitudes of 2 divisions and more. Signal must be in vertical center of screen. Adjust the Δ control (DEL'D TB trigger level) if necessary.

- Repeat the procedure for CH2, CH3 and CH4 for the frequencies 50 kHz (0.6 division input signal) and 200 MHz (2 division input signal)
- Press the DSO key ('DIGITAL MODE ' is displayed briefly), and repeat the tests in this chapter for the digital mode.
- Then press the DSO key (message ANALOG MODE is displayed briefly) to return to analog mode.

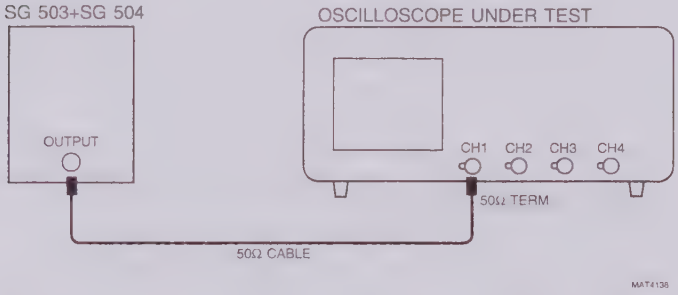
6.3.39 Trigger sensitivity in logic mode PM3392/3394

The trigger sensitivity in the logic mode 'pattern' depends on the amplitude and frequency of the trigger signal. In this test, the trigger sensitivity is tested with a sine wave via the CH1, CH2, CH3, and CH4 inputs.

Test equipment:

Constant amplitude sine wave generator (SG 503)

Test setup:



1 - Press the DSO key ('DIGITAL MODE' is displayed briefly) to activate the digital mode.
2 - Apply a 100 MHz sine-wave signal of 1 V(pp into 50 ohm) from the constant amplitude sine-wave generator to input CH1.
3 - Press the AUTOSET key, and set CH1 to 0.5V/division.
4 - Use a 50 ohm termination. For instruments with switchable 50 ohm input impedance it is recommended to make use of this feature.
5 - Set the input coupling to DC and POSition the signal in the vertical center of the screen.
6 - Select 5.00 ns/division for MAIN TB.
7 - Press the TRIGGER menu key and select 'logic', 'pattern', and 'enter' from the related menu.
8 - Operate the front panel keys TRIG1, TRIG2, TRIG3 and TRIG4 to obtain the trigger pattern Hxxx (x = don't care) in the menu.
9 - Press the TB MODE menu key and select 'trig' from the related menu.
10 - Decrease the amplitude of the generator voltage to 1 division.
11 - Turn the TRIGGER LEVEL control and check that a well-triggered signal is obtained.
12 - Apply a 300 MHz sine-wave signal of 2 V(pp into 50Ω) from the SG 504 to input CH1.
13 - Adjust the input voltage to 2 divisions.
14 - Verify that the signal is well triggered at amplitudes of 2 divisions and more; adjust TRIGGER LEVEL when necessary.
15 - Press the DSO key ('ANALOG MODE' is displayed briefly) to return to analog mode.

Repeat the procedure for CH2 with trigger pattern xHxx
Repeat the procedure for CH3 with trigger pattern xxHx
Repeat the procedure for CH4 with trigger pattern xxxH

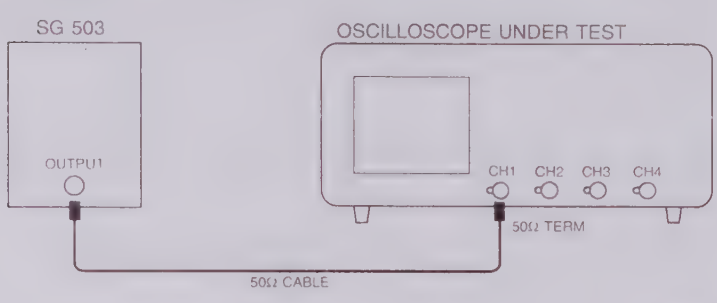
6.3.40 Trigger sensitivity in logic mode PM3382/3384

The trigger sensitivity in the logic mode 'pattern' depends on the amplitude and frequency of the trigger signal. In this test, the trigger sensitivity is tested with a sine wave via the CH1, CH2, CH3, and CH4 inputs.

Test equipment:

Constant amplitude sine wave generator (SG 503)

Test setup:



1 - Press the DSO key ('DIGITAL MODE' is displayed briefly) to activate the digital mode.
2 - Apply a 50 MHz sine-wave signal of 1 V(pp into 50 ohm) from the constant amplitude sine-wave generator to input CH1.
3 - Press the AUTOSET key, and set CH1 to 0.5V/division.
4 - Use a 50 ohm termination. For instruments with switchable 50 ohm input impedance it is recommended to make use of this feature.
5 - Set the input coupling to DC and POSition the signal in the vertical center of the screen.
6 - Select 5.00 ns/division for MAIN TB.
7 - Press the TRIGGER menu key and select 'logic', 'pattern', and 'enter' from the related menu.
8 - Operate the front panel keys TRIG1, TRIG2, TRIG3 and TRIG4 to obtain the trigger pattern Hxxx (x = don't care) in the menu.
9 - Press the TB MODE menu key and select 'trig' from the related menu.
10 - Decrease the amplitude of the generator voltage to 1 division.
11 - Turn the TRIGGER LEVEL control and check that a well-triggered signal is obtained.
12 - Increase the input frequency to 200 MHz.
13 - Increase the input voltage to 2 division.
14 - Turn the TRIGGER LEVEL control, and check that a well-triggered signal is obtained.
15 - Press the DSO key ('ANALOG MODE' is displayed briefly) to return to analog mode.

Repeat the procedure for CH2 with trigger pattern xHxx
Repeat the procedure for CH3 with trigger pattern xxHx
Repeat the procedure for CH4 with trigger pattern xxxH

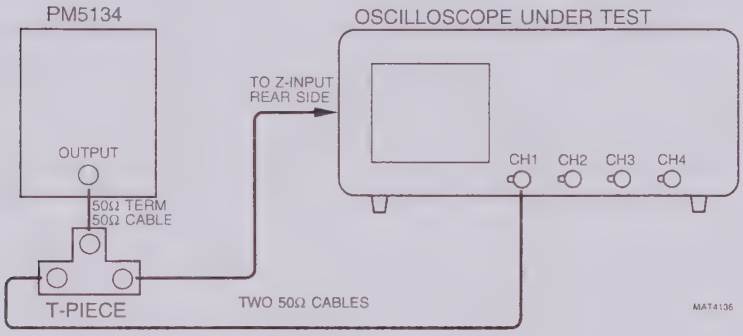
6.3.41 Z-MOD sensitivity

This test checks the sensitivity of the Z modulation facility.

Test equipment:

- Square-wave generator (function generator PM 5134 or PM 5138)
- T-piece

Test set-up:



Settings/procedure and requirements:

1 - Apply a 1 kHz square-wave signal, duty cycle 50%, amplitude between 0 to +2.5V (into 50Ω), to input CH1. Use a 50Ω termination directly at the generator output.
2 - Press the AUTOSET key.
3 - Set MTB to 0.5 ms/div.
4 - Set the trace of CH1 in mid position with the CH1 POS control.
5 - Apply the same signal by means of the T-piece to the Z input (rear side).
6 - Adjust INTENS TRACE so that only the bottom half of the squarewave is displayed. The top half must be invivisible (0.5 ms light on; 0.5 ms light off).
7 - Decrease the input signal to 0.5V.
8 - Set CH1 to 0.5V/division.
9 - Verify that the top half of the square wave is visible at full intensity.

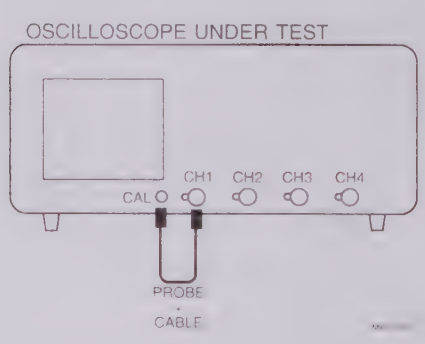
6.3.42 CAL signal; frequency and output voltage

The CAL signal is a calibration signal with fixed frequency and voltage. In this test, the values of frequency and voltage are checked.

Test equipment:

None

Test set-up:



Settings/procedure:

1 - Connect the CAL signal to input CH1 and press the AUTOSET key.
2 - Select GND of CH1.
3 - Set the trace in the center of the screen.
4 - Switches GND of CH1 off.
5 - Select DC input coupling for CH1.

Requirements:

1 - Verify that a positive going square-wave signal with an amplitude between 570 ... 630 mV (pp) is displayed, i.e. between 2.85 ... 3.15 divisions at 200 mV/div.
2 - Verify that the frequency of the displayed signal is about 2 kHz, i.e. a period time between 4.0 ... 6.0 divisions horizontal at MTB 100 µs/div.

7 CALIBRATION ADJUSTMENT PROCEDURE

7.1 INTRODUCTION

The calibration adjustment procedure can be split up in two:
- Manual adjustment
- Automatic calibration (AUTOCAL).

All calibration is done with the oscilloscope's cabinet closed. This eliminates calibration inaccuracies due to temperature changes.

Manual calibration data are protected by a keyword and a seal and must be changed by qualified personnel only. Some of the adjustments require external calibration equipment. A list of necessary equipment is given in chapter 6 (performance test). Manual calibration should be done after 2000 service hours or once a year.

Operation of the front panel CAL key activates the automatic calibration. AUTOCAL can only function usefully if the manual adjustments (especially the 'screen calibrations') are correct. The AUTOCAL function should in general be activated once a week. AUTOCAL should be used always after warming-up if the oscilloscope is used in extreme environmental conditions such as very high or low temperatures while maximum accuracy is needed. AUTOCAL requires no external calibration equipment.

The calibration adjustment should be started after a warming-up time of 30 minutes.

The most accurate adjustments are done with a well-focused low intensity display.

The calibration parameters are saved after power-down if the memory back-up batteries are installed. Additionally these parameters can be saved into the instrument's non-volatile memory. This is done by pressing softkey 'save calibr data' and then activation of the pin hole key. The number of times that this save action can be done is limited. The memory is full after a number (10x) of actions and needs to be cleared. Refer to chapter 8 (corrective maintenance) for how to proceed then.

7.2 DARK LEVEL OF CRT.

- Press the STATUS and TEXT OFF keys simultaneously: this gives a defined position of the instrument settings.
- Adjust MTB/VAR to 1.00 ms/div.
- Select the key sequence 'UTIL > MAINTENANCE > ENTER KEYWORD'.
- Enter the five digit keyword '3 2 4 1 5'. If correct, an automatic return to the UTIL MAINTENANCE menu is done.
- Press softkey MANUAL CALIBR.
- Select 'dark' with the TRACK rotary.
- Press softkey 'analog': the Δ sign is displayed behind 'analog'.
- Put the INTENS TRACE rotary in minimal intensity position.
- Adjust the Δ rotary so that the dot at the beginning of the CH1 trace is just invisible. Use X POS to move the start of the trace away from the ground level indicator.
- Press softkey 'digital': the Δ sign is displayed behind 'digital'.
- Press the front panel key 'DSO' (message DIGITAL MODE appears briefly) and the oscilloscope switches to digital mode.
- Put the INTENS TRACE rotary in minimal intensity position.
- Adjust the Δ rotary so that the CH1 trace is just invisible.
- Put INTENS TRACE rotary in normal intensity position again.
- Press softkey RETURN to go to the UTIL MAINTENANCE MENU.

7.3 TRACE ROTATION.

* Press the DSO key (message ANALOG MODE appears briefly) and the oscilloscope switches to analog mode.
- Adjust the INTENS TRACE rotary for a well-visible horizontal on the screen.
- Align the CH1 trace exactly in parallel with the horizontal graticule lines using screw-driver operated TRACE ROT rotary.

7.4 HORIZONTAL (X) GAIN AND OFFSET (CRT).

- Press softkey SCREEN CALIBR. This activates the UTIL SCREEN CALIBR CRT menu.
- Select 'x-gain' with the softkeys.
- Adjust the TRACK (gain) and ∧ (offset) rotary so that the two vertical lines coincide exactly with the 3rd and 9th graticule line.

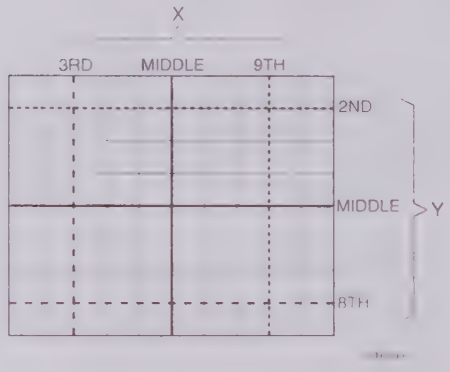


Figure 7.1 Position of lines for horizontal (X) and vertical (Y) gain and offset calibration.

7.5 TEXT STABILITY AND X-OFFSET (CRT).

- Select 'x-text' with the softkeys (menu header is UTIL SCREEN CALIBR CRT).
- Adjust the TRACK rotary to maximal stability of the text
- Adjust the Δ rotary so that the vertical line is exactly in the middle of the graticule.

7.6 VERTICAL (Y) GAIN AND OFFSET (CRT).

- Select 'y-gain' with the softkeys (menu header is UTIL SCREEN CALIBR CRT).
- Adjust the TRACK (gain) and Δ (offset) rotary so that the two horizontal lines coincide exactly with the 2nd and 8th graticule line.
- Select 'y-offs' with the softkeys.
- Adjust the TRACK rotary so that the horizontal line is exactly in the middle of the graticule.

7.7 HORIZONTAL GAIN AND OFFSET (VECTOR).

- Push the second softkey again to obtain 'x-gain' (menu header is changed into UTIL SCREEN CALIBR VECTOR).
- Adjust the TRACK rotary to minimal over- or undershoot in horizontal direction.
- Select 'x-offs' with the softkeys.
- Adjust the TRACK rotary so that the lines of the test pattern coincide exactly with the graticule in horizontal direction.

7.8 VERTICAL GAIN AND OFFSET (VECTOR)

- Select 'y-gain' with the softkeys (menu header is UTIL SCREEN CALIBR VECTOR).
- Adjust the TRACK rotary to minimal over- or undershoot in vertical direction.
- Select 'y-offs' with the softkeys.
- Adjust the TRACK rotary so that the lines of the test pattern coincide exactly with the graticule in vertical direction.
- Press softkey 'accept' if the screen calibrations are correct.
- Press softkey RETURN to go to the UTIL MAINTENANCE MENU.

7.9 ASTIGMATISM.

- Press softkey MANUAL CALIBR.
- Select 'astig' with the TRACK rotary.
- Position the CH1 trace in the centre of the graticule.
- Adjust the Δ rotary for the best possible sharpness of text across the screen: the small dots from which the text is composed must be well visible. Adjustment of the FOCUS rotary is necessary during the adjustment.

7.10 AUTOCAL PROCEDURE.

- Press the CAL key during 2 seconds.
- Within 4 minutes the instrument automatically does its main calibrations.
- Watch the CRT and check that no errors are reported. If errors are mentioned, the oscilloscope will need corrective maintenance. The error number indicates in what part of the oscilloscope the fault may be expected.

7.11 LF SQUARE-WAVE RESPONSE CH1.

- Press the STATUS and TEXT OFF keys simultaneously: this gives a defined position of the instrument settings.
- Select the key sequence UTIL > MAINTENANCE > MANUAL CALIBR.
- Select 'lf ch1' with the TRACK rotary.
- Select 'lfx100' with the softkeys: the Δ sign is displayed behind 'lfx100'.
- Put CH1 in 1 V/div with DC coupled input.
  Apply a 100 kHz square-wave signal of 5 V peak-peak from a function generator to CH1.
  Select 50Ω input impedance; if not available use a 50Ω termination resistor between cable and oscilloscope input.
- Adjust MTB/VAR to 2.00 µs/div.
- Adjust the Δ rotary for a flat pulse top.

- Select 'lfx10' with the softkeys: the Λ sign is displayed behind 'lfx10'.
- Put CH1 in 0.1 V/div.
- Change the square-wave signal into 10 kHz/500 mV peak-peak.
- Adjust MTB/VAR to 20.0 µs/div.
- Adjust the Δ rotary for a flat pulse top.
- Remove the input signal.

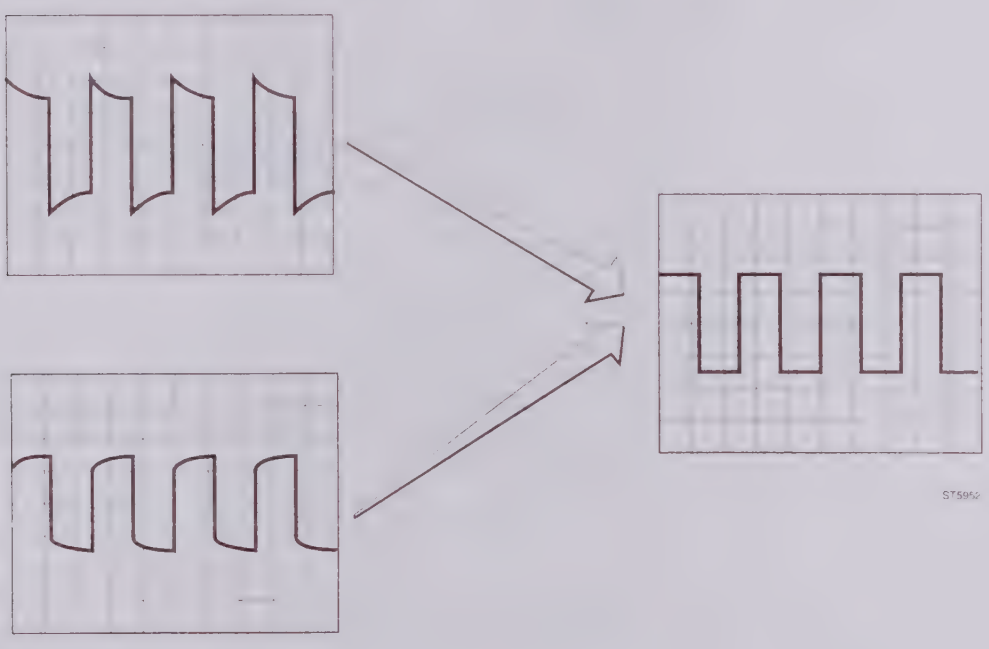


Figure 7.2 Adjustment of LF square wave response CH1, CH2, CH3 and CH4.

7.12 LF SQUARE-WAVE RESPONSE CH2.

- Select 'lf ch2' with the TRACK rotary.
- Select 'lfx100' with the softkeys: the Δ sign is displayed behind 'lfx100'.
- Switch CH2 to ON and CH1 off.
- Press the TRIG 2 key.
- Put CH2 in 1 V/div with DC coupled input.
- Apply a 100 kHz square-wave signal of 5 V peak-peak from a function generator to CH2.
- Select 50Ω input impedance; if not available use a 50Ω termination resistor between cable and oscilloscope input.
- Adjust MTB/VAR to 2.00 µs/div.
- Adjust the Δ rotary for a flat pulse top.

- Select 'lfx10' with the softkeys: the Δ sign is displayed behind 'lfx10'.
- Put CH2 in 0.1 V/div.
- Change the square-wave signal into 10 kHz/500 mV peak-peak.
- Adjust MTB/VAR to 20.0 µs/div.
- Adjust the Δ rotary for a flat pulse top.
- Remove the input signal.

7.13 LF SQUARE-WAVE RESPONSE CH3.

- Select 'lf ch3' with the TRACK rotary.
- Select 'lfx100' with the softkeys: the Δsign is displayed behind 'lfx100'. This is not necessary in PM3382/PM3392: for these instruments only the step 'lfx10' has to be adjusted.
- Switch CH3 to ON and CH2 off.
- Press the TRIG 3 key.
- Put CH3 in 1 V/div with DC coupled input.
- Apply a 100 kHz square-wave signal of 5 V peak-peak from a function generator to CH3.
- Select 50Ω input impedance; if not available use a 50Ω termination resistor between cable and oscilloscope input.
- Adjust MTB/VAR to 2.00 µs/div.
- Adjust the Δ rotary for a flat pulse top.

- Select 'lfx10' with the softkeys: the Δ sign is displayed behind 'lfx10'.
- Put CH3 in 0.1 V/div.
- Change the square-wave signal into 10kHz/500 mV peak-peak.
- Adjust MTB/VAR to 20.0 µs/div.
- Adjust the Δ rotary for a flat pulse top.
- Remove the input signal.

7.14 LF SQUARE-WAVE RESPONSE CH4.

- Select 'lf ch4' with the TRACK rotary.
- Select 'lfx100' with the softkeys: the Δ sign is displayed behind 'lfx100'. This is not necessary in PM3382/PM3392: for these instruments only the step 'lfx10' has to be adjusted.
- Switch CH4 to ON and CH3 off.
- Press the TRIG 4 key.
- Put CH4 in 1 V/div with DC coupled input.
- Apply a 100 kHz square-wave signal of 5 V peak-peak from a function generator to CH4.
- Select 50Ω input impedance; if not available use a 50Ω termination resistor between cable and oscilloscope input.
- Adjust MTB/VAR to 2.00 µs/div.
- Adjust the Δ rotary for a flat pulse top.

- Select 'Ifx10' with the softkeys: the Δ sign is displayed behind 'Ifx10'.
- Put CH4 in 0.1 V/div.
- Change the square-wave signal into 10 kHz/500 mV peak-peak.
- Adjust MTB/VAR to 20.0 µs/div.
- Adjust the Δ rotary for a flat pulse top.
- Remove the input signal.

7.15 HF SQUARE-WAVE RESPONSE FINAL Y AMPLIFIER.

- Apply a 900 mV/1 MHz square-wave signal with a rise-time faster than 1 nsec to CH1. This signal is delivered by the fast-rise output of the square-wave calibration generator. Use a 10x attenuator at the end of the cable from the generator.
- Press AUTOSET.
- Put CH1 in 20 mV/div with DC coupled input.
- Select 50Ω input impedance; if not available use a 50Ω termination resistor directly at the oscilloscope input.
- Adjust MTB/VAR to its fastest position (20.0 or 50.0 ns/div). Small adjustments of MTB/VAR may be necessary to have a good view of signal details of interest.
- Select the key sequence 'UTIL > MAINTENANCE > MANUAL CALIBR' and then select 'hf y' with the TRACK rotary .
- Select in succession 'pulse t4', 'pulse t3', 'pulse t2', 'pulse t1' and 'pulse t0' with the softkeys. Adjust the pulse top to maximum flatness and the risetime to the required value with the Δ rotary. The adjustments are a compromise between fast risetime and minimal pulse distortion (aberrations). The influence of these adjustments ranges from mid-frequency (pulse t4) to high-frequency (pulse t0). The requirement is a rise-time of ≤ 3,6 ns for 100 MHz instruments and ≤ 2 ns for 200 MHz. This value includes the generator rise-time. The pulse aberrations must not exceed + or - 6%.

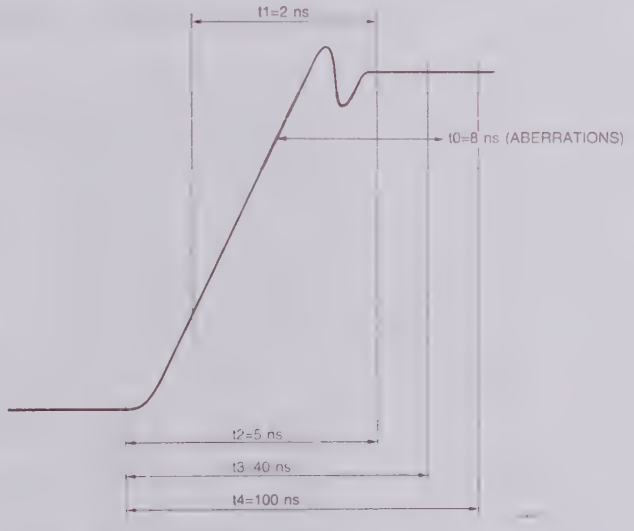


Figure 7.3 Influence of t4, t3, t2, t1 and t0 on HF square wave response.

- Remove the input signal.
- Pulse response and bandwidth are interdependent: the higher the pulse aberrations, the higher the bandwidth and vice versa. To check the bandwidth apply a 120 mV/50 kHz sinewave from a constant amplitude sinewave generator to CH1.
- Press AUTOSET.
- Select 50Ω input impedance; if not available use a 50Ω termination resistor directly at the oscilloscope input.
- Adjust the amplitude of the sine-wave to 6 div exactly.
- Increase the frequency of the sinewave up to 100 MHz (for 100 MHz instruments) or 200 MHz (for 200 MHz instruments) and check that the amplitude on the screen does not become smaller then 4,2 div.
  Remove the input signal.
- Repeat the bandwidth check for CH2, CH3 and CH4 (the bandwidth check for CH3 and CH4 of PM3392 must be checked via the 10:1 probe that is delivered with the oscilloscope).
- Remove the input signal.

7.16 HF RESPONSE DSO MODE

Note: the following adjustments have to be done in sequence for CH1, CH2, CH3 and CH4.

- Press the DSO key (message DIGITAL MODE appears briefly) and the oscilloscope switches to digital mode.
- Apply a 900 mV/1 MHz square-wave signal with a rise-time faster than 1 nsec to CH1 (CH2, CH3, CH4). This signal is delivered by the fast- rise output of the square-wave calibration generator. Use a 10x attenuator at the end of the cable from the generator.
- Press AUTOSET.
- Put CH1 (CH2, CH3, CH4) in 20 mV/div with DC coupled input.
- Put MTB/VAR in 5.00 ns/div position.
- Select 50Ω input impedance; if not available use a 50Ω termination resistor directly at the oscilloscope input.
- Use POS CH1 (POS CH2, POS CH3, POS CH4) to position the signal in the vertical mid of screen.
- Adjust the TRIGGER LEVEL to -100%.
- Select key sequence UTIL > MAINTENANCE > MANUAL CALIBR and then 'hfdso' with the TRACK rotary.
- Select 'hf CH1' ('hf CH2', 'hf CH3', 'hf CH4') with the softkeys: the Δ sign appears behind 'hf CH1' ('hf CH2', 'hf CH3', 'hf CH4'). Adjust the pulse top to maximum flatness and the risetime to the required value with the Δ rotary. The adjustments are a compromise between fast risetime and minimal pulse distortion (aberrations). The requirement is a rise-time of ≤ 3,6 ns for 100 MHz instruments and ≤ 2 ns for 200 MHz. This value includes the generator rise-time. The pulse aberrations must not exceed + or - 8%.
- Remove the input signal from CH1 (CH2, CH3, CH4).
- Check for an equal pulse response (rise-time and aberrations) of CH1, CH2, CH3 and CH4 in 20 mV/div. In case of major differences, repeat the adjustment for a pulse response as equal as possible.
- Remove the input signal.

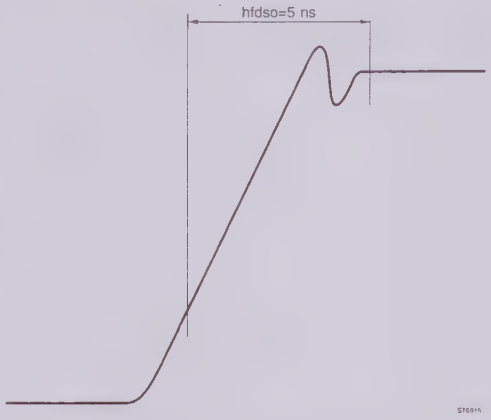


Figure 7.4 Influence of 'hfdso' on HF square wave response.

- Pulse response and bandwidth are interdependent: the higher the pulse aberrations, the higher the bandwidth and vice versa. To check the bandwidth applby a 120 mV/50 kHz sinewave from a constant amplitude sinewave generator to CH1.
- Press AUTOSET.
- Select 50Ω input impedance; if not available use a 50Ω termination resistor directly at the oscilloscope input.
- Adjust the amplitude of the sine-wave to 6 div exactly.
- Increase the frequency of the sinewave up to 100 MHz (for 100 MHz instruments) or 200 MHz (for 200 MHz instruments) and check that the amplitude on the screen does not become smaller then 4,2 div.
- Remove the input signal.

- Repeat the bandwidth check for CH2, CH3 and CH4 (the bandwidth check for CH3 and CH4 of PM3392 must be checked via the 10:1 probe that is delivered with the oscilloscope).
- Remove the input signal.

7.17 TRIGGER DELAY ADJUSTMENT.

- Apply a 900 mV/1 MHz square-wave signal with a rise-time faster than 1 nsec to CH1. This signal is delivered by the fast-rise output of the square-wave calibration generator.
- Press AUTOSET.
- Put CH1 in 0.2 V/div with DC coupled input.
- Select 50Ω input impedance; if not available use a 50Ω termination resistor directly at the oscilloscope input.
- Position the signal exactly in the vertical mid of screen.
- Put MTB/VAR TIME/DIV in 2.00 ns/div (200 MHz instruments) or in 5.00 ns/div (100 MHz instruments) position.
- Press menu key TRIGGER and select 'edge', level-pp 'off' and 'dc' trigger coupling.
- Turn the TRIGGER LEVEL rotary and adjust the level indicator (-T) 0.2 div under the vertical mid of screen
- Adjust the TRIGGER POSITION rotary to a Delay read out of -5 div.
- Select the key sequence UTIL > MAINTENANCE > MANUAL and then select 'tr com' with the TRACK rotary .
  Select 'edge' with the softkey: the Δ sign appears behind 'edge'.
- Adjust the Δ rotary so that the leading edge crosses the center of the screen.

- Press menu key TRIGGER and select 'logic' and 'state'.
- Use the front panel keys TRIG1 ... TRIG4 to obtain the trigger pattern '↑xxx' in the TRIGGER MAIN TB menu.
- Turn the TRIGGER LEVEL rotary and adjust the level indicator (-T) 0.2 div under the vertical mid of screen.
- Select the key sequence UTIL > MAINTENANCE > MANUAL and then select 'tr com' with the TRACK rotary .
- Select 'logic' with the softkey: the Δ sign appears behind 'logic'.
- Adjust the Δ rotary so that the leading edge crosses the center of the screen.

- Select key sequence TB MODE > EVENT DELAY > 'on' and 'CHANNEL 1'.
- Turn the TRIGGER LEVEL rotary and adjust the level indicator (-T) 0.2 div under the vertical mid of screen.
- Turn the Δ rotary to adjust the event level indicator (-E) 0.2 div under the vertical mid of screen.
- Select the key sequence UTIL > MAINTENANCE > MANUAL and then select 'tr com' with the TRACK rotary .
- Select 'events' with the softkey: the Δ sign appears behind 'events'.
- Adjust the Δ rotary so that the leading edge crosses the center of the screen.

- Select the key sequence TB MODE > EVENT DELAY > off.
- Press menu key TRIGGER and select 'edge'.
- Press menu key MODE and select DEL'D TB on, trig'd, dc and MAIN TB off.
- Put MAIN TB TIME/DIV to 100 ns/div and DEL'D TB TIME/DIV to 20.0 ns/div.
- Adjust MAGNIFY to 4x.
- Turn the Δ rotary (DTB TRIGGER LEVEL) and adjust the level indicator (-D) 0.2 div under the vertical mid of screen.
- Select the key sequence UTIL > MAINTENANCE > MANUAL and then select 'tr com' with the TRACK rotary .
- Select 'dtb' with the softkey: the Δ sign appears behind 'dtb'.
- Adjust the Δ rotary so that the leading edge crosses the center of the screen.

7.18 SAVING THE CALIBRATION DATA.

If you are sure that the instrument is well calibrated, the calibration data must be saved. For this proceed as follows:

- Press softkey RETURN.
- If present, remove the calibration sticker from the pin hole.
- Press softkey 'save calibr data'.
- Press the pin hole key (e.g. with a paperclip). When doing this, it is indicated in the viewing area how many 'calibration fields' are free to save calibration data.

Note: The number of times that this 'save' action can be done is limited to 10. Refer to chapter 8.9.2 for how to proceed if the memory is full.

- Close the pin hole key with a new calibration sticker, part number 5322 455 81144.

7.19 TESTING THE INSTRUMENT'S PERFORMANCE

If you want, you can check the instrument's performance by means of chapter 6 'PERFORMANCE TEST'. In general a quick check of the instrument's main characteristics will be sufficient. For this use the following paragraphs in chapter 6 of this manual:

- Vertical deflection; deflection coefficients (6.3.6).
- Horizontal deflection; MAIN TB deflection coefficients (6.3.24).
- Horizontal deflection; delayed time-base deflection coefficients (6.3.27).

8 CORRECTIVE MAINTENANCE PROCEDURES

8.1 DISMANTLING THE INSTRUMENT

8.1.1 General information

This section contains the dismantling procedures required for the removal and testing of components during repair.
All circuit boards removed from the instrument must be adequately protected against damage, and all normal precautions regarding the use of tools must be observed.
During the dismantling a careful note must be made of all disconnected leads so that they can be reconnected to their correct terminals during assembly.

CAUTION: Damage may result if:
- **The instrument is switched-on when a circuit board has been removed.**
- **A circuit board is removed within one minute after switching-off the instrument.**

8.1.2 Removing the cabinet and carrying handle

Note: The cabinet does not need to be removed to do the calibration adjustment procedure.

To remove the cabinet proceed as follows:
- Fit the front cover on to the instrument.
- Hinge the carrying handle clear of the front cover.
- Place the instrument with the front cover on a flat surface.
- Pull off both plastic parts that are around the instrument's rear feet.
- Remove the screws (6) that secure the cabinet to the instrument's rear panel.
- Gently slide the cabinet (and carrying handle) off the instrument.

ATTENTION:
- *When installing the cabinet again, special care must be taken that cables are not damaged between the cabinet and the chassis. This is especially important for the flat cable above the Cathode Ray Tube (CRT) that connects Front unit A4 and CRT controls unit A5.*
- *Also take care that the cabinet fits well into the plastic front frame and that grounding fingers are not damaged during installation.*

The rotation points of the carrying handle are secured by means of metal 'omega' clips. After removal of these clips the handle can be removed by pulling both handle ends outwards away from the instrument.

8.2 REPLACEMENTS

WARNING: The Extremely High Tension (EHT) cable is directly connected to the EHT-multiplier unit. When the EHT cable to the post-acceleration anode is disconnected, the cable must be discharged by shorting the terminal to the instrument's earth.

8.2.1 Standard parts

Electrical and mechanical replacement parts can be obtained through your local PHILIPS/FLUKE organization or representative. However, many of the standard electronic components can be obtained from other local suppliers. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating and description.

NOTE: Physical size and shape of a componenent may affect the instrument's performance, particularly at high frequencies. Always use direct-replacement components, unless it is known that a substitute will not degrade the instrument's performance.

8.2.2 Special parts

In addition to the standard electronic components, some special components are used:
- Components, manufactured or selected by PHILIPS to meet specific performance requirements.
- Components which are important for the safety of the instrument.

ATTENTION: Both type of components may only be replaced by components obtained through your local PHILIPS/FLUKE organization of representative.

8.2.3 Transistors and Integrated Circuits

- Return transistors and IC's to their original positions, if removed during routine maintenance.
- Do not replace or switch semi-conductor devices unnecessarily, as it may affect the calibration of the instrument.
- Any replacement component should be of the original type or a direct replacement. Bend the leads to fit the socket or p.c.b. holes and cut the leads to the same length as on the component being replaced. See also the Performance Test in this manual.
- When a device has been replaced, check the operation of the part of the instrument that may be affected.

8.3 STATIC SENSITIVE COMPONENTS

In the oscilloscope the black/yellow 'static sensitive components' symbol is present (see also figure 8.1). This means that this instrument contains electrical components that can be damaged by electrostatical discharge. Although all MOS integrated circuits incorporate protection against electrostatic discharge, they nevertheless can be damaged by accidental over-voltages.

Figure 8.1 Static sensitive symbol (black/yellow)

It is also possible that a delayed failure or 'wounding' effect may occur. When this happens the component will fail anywhere between two hours to six months later.

In storing and handling static sensitive components, the normal precautions for these devices are recommended. Handling and servicing static sensitive assemblies and components should be performed only at a static free workstation by qualified personnel.

CAUTION: **Testing, handling and mounting call for special attention. Personnel, handling static sensitive devices, should normally be connected to ground via a high-ohmic resistor.**

Extensive information on how to deal with static sensitive components is contained in Support Bulletin OSC296 (ordering number 4822 872 08407).

8.4 SOLDERING TECHNIQUES

8.4.1 General soldering techniques

Working method:

- Carefully unsolder the soldering tags of a semi-conductor one after the other.
- Remove all superfluous soldering material. Use desolder braided wire; ordering code: 4822 321 40042.
- Check that the leads of the replacement part are clean and pre-tinned on the soldering places.
- Place the replacement semiconductor exactly in the same position, and solder each lead to the relevant printed conductor on the printed circuit board.

NOTE: The maximum permissible soldering time is 10 seconds during which the temperature of the leads must not exceed 250 °C. The use of solder with a low melting point is recommended. Take care not to damage the plastic encapsulation of the semiconductor (softening point of the plastic is 150 °C).

ATTENTION: When you are soldering inside the instrument it is essential to use a low voltage soldering iron, the tip of which must be grounded to the chassis of the oscilloscope.

A suitable soldering iron is:
Mini soldering iron station, WECP-COD3 (regulated transformer) and Weller LR-20 (soldering iron).

Ordinary 60/40 solder with core and 35 ... 40 W pencil-type soldering iron can be used to do the majority of the soldering. If a higher wattage-rating soldering iron is used on the printed circuit board, excessive heat can cause the circuit wiring to separate from the base material.

8.4.2 Soldering micro-miniature semi-conductors

Because of the small dimensions of these SOT semi-conductors and the lack of space between the components on the printed circuit board, it is necessary to use a miniature soldering iron with a pin-point tip (max. diameter 1mm) to solder a SOT on to a printed circuit board.

Suitable soldering tools are:
- Mini soldering iron station, WECP-COD3 (regulated transformer) and Weller MLR-20 (mini soldering iron).
- A hot-air solder tool: Leister Hot-Jet.

Next, the following materials are recommended:
- Soldering tin, diameter 0.8 mm, SnPb 60/40 with a Resin Mildly Activated (RMA) flux. Ordering code: 4822 390 80133.
- Desolder braided wire; ordering code 4822 321 40042.
- Solder paste 26.
- Non-corrosive and Resin Mildly Activated (RMA) flux-Colophony. Ordering code: 4822 390 50025.

Refer to the Support Bulletin OSC296 (ordering code 4822 872 08407) for a complete discussion of the soldering techniques for SMD's.

8.5 REMOVING THE UNITS, MECHANICAL PARTS AND CRT

NOTE: For installation, reverse the sequence.

8.5.1 Removing the rotary knobs

Rotary knobs can be removed by simply pulling them off. The knobs have an integrated shaft and fixing device. Most of the knobs (11) have a light grey colour. The knobs for cursor positioning are dark grey. The knobs DELAY and LEVEL DTB are almost white ('dark mushroom').

For installation push the rotary into its hole, rotate it gently until it clicks into place.

8.5.2 Detachment of ribbon cables

The white ribbon cables are used together white connectors with integrated locking device. Proceed as follows to take the cable out of the connector:

- Lift the outside part of the connector: this unlocks the cable.
- Pull the ribbon cable out of the connector.

Proceed as follows to connect the the ribbon cable again:

- Push the ribbon cable fully into the connector. The blue line on the cable must be on the connector side where the contacts are visible (in unlocked position). Figure 8.2 explains this.
  Push down the outside part of the connector in order to lock the cable.

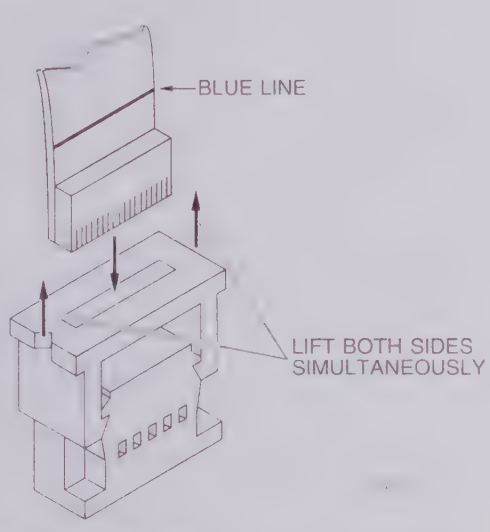


Figure 8.2 Mounting position of white ribbon cables in connector

8.5.3 Removal of signal unit A1

- Remove 3 screws with washers that fix the printed circuit board to the chassis plate.
- Remove 1 long screw that fixes (and grounds) the screen of the input attenuators to the chassis plate.
- Unplug the blue ribbon cable.
- Lift the rear side of the unit over the plastic stud and slide the unit backwards: the unit becomes loose from the chassis now.

NOTE: The unit can be toppled over. The SMD component side is accessible now and can be measured in working condition after reinstallation of the blue ribbon cable. Figure 8.4 shows this.

- Unplug the white ribbon cable and the coaxial delayline connector.
- Unplug the connectors for the output options (MTB gate, DTB gate, MTB sweep) if they are present in the instrument.
- Remove the unit from the instrument.

For removal of the screen of the attenuators proceed as follows:
Pull off the plactic bracket between the BNC inputs.
Remove the two screws between the BNC's.
Remove the two screws in the sides of the screening plate.

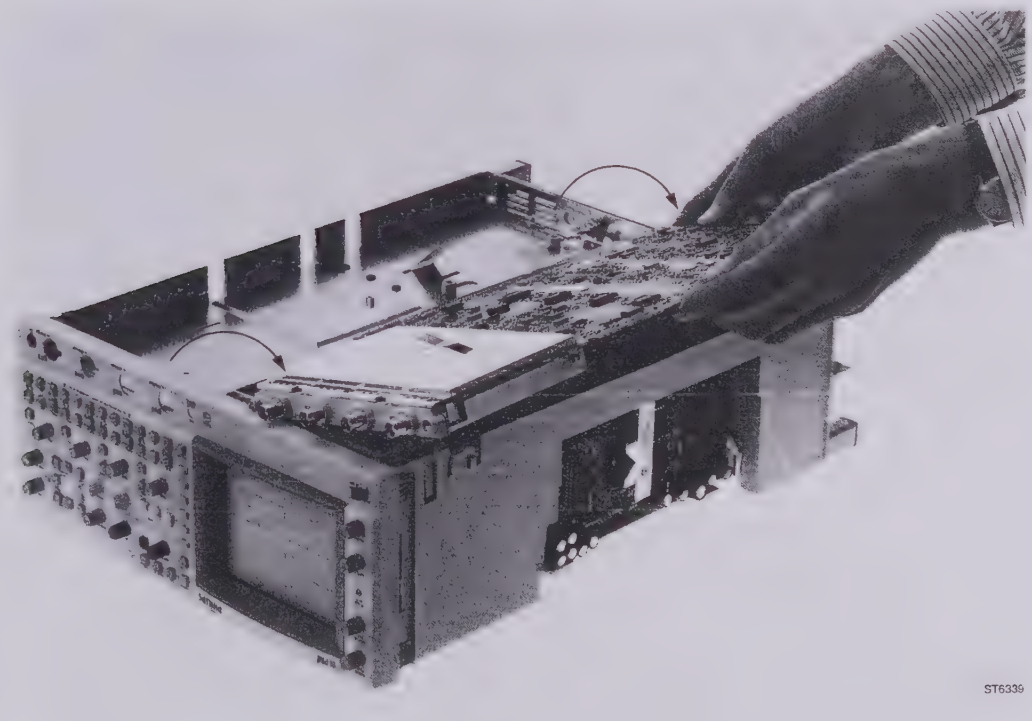


Figure 8.3 Signal unit in position to measure SMD component side

8.5.4 Removal of Final XYZ amplifier unit A2

ATTENTION: On the XYZ unit there are parts that carry high voltages. If working on the unit under live condition cannot be avoided, it must be done by a qualified technician who is aware of the dangers involved.

- Remove the screw that secures (and grounds) the unit to the bottom chassis plate.
- Disconnect the 4 wires that lead to the CRT (The X- and Y-deflection plates): this action must be done carefully to avoid damage to the side connections of the CRT. For correct reinstallation refer to the wiring diagram in chapter 4.2.
- Bend out the two clamping lips that secure the unit at the top side. The unit is loosened now.

NOTE: The unit can be put now in an inclined position as shown in figure 8.3. Measuring on the SMD-component side in working condition is possible then. Measuring the output wires that lead to the X- and Y-deflection plates is possible with a 10 kΩ damping resistor between measuring point and probe tip. This avoids oscillations.

- Unplug two ribbon cables and take the unit out of the chassis.
- Unplug the delayline connector.

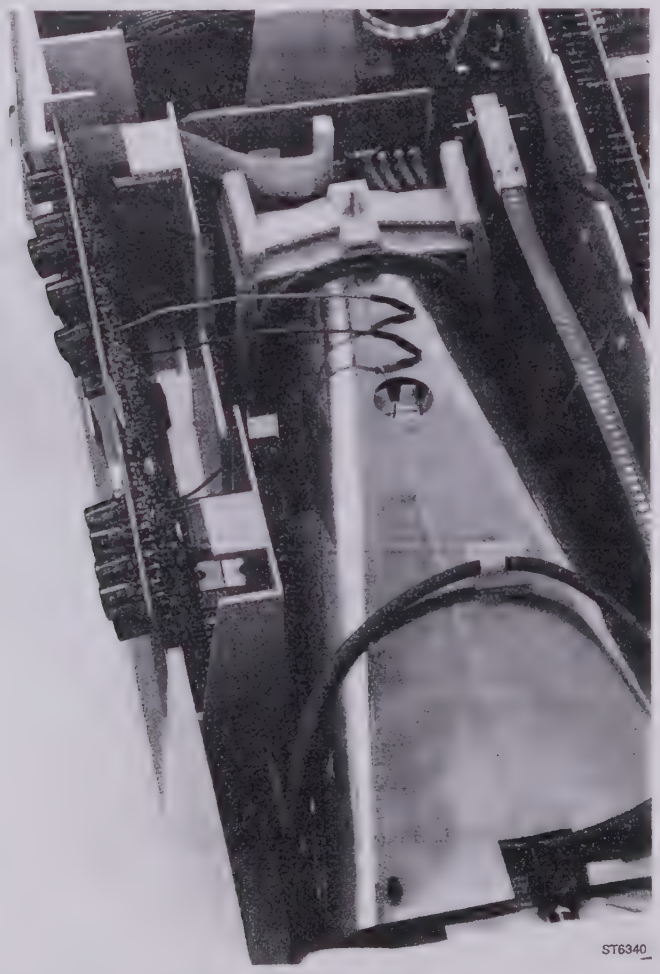


Figure 8.4 Final XYZ amplifier in inclined position

8.5.5 Removal of unit at socket of CRT

WARNING: On this unit there are parts that carry dangerous high voltages (-2.2 kV). Some of these voltages remain some time after disconnecting the instrument from the mains. Therefore it is recommended to wait at least five minutes after having disconnected the instrument from the mains, before removing the printed circuit board. If working on the unit under live condition cannot be avoided, it must be done by a qualified technician who is aware of the dangers involved.

Now proceed as follows:
- Unplug the ribbon cable at the Final XYZ amplifier or at the CRT socket unit.
- Pull the unit gently off the CRT socket.
- Unplug the -2.2 kV cathode/filament (3 wires).

8.5.6 Removal of Cathode Ray Tube (CRT)

IMPORTANT:
- *Handle the CRT and its side connections carefully. Rough handling or scratching can cause the CRT to implode.*
- *When installing the CRT, first remove its protective cover. Then take care that its screen is pressed tight to the front side of the chassis.*

- Remove the unit from the socket of the CRT (refer to 8.5.5).
- Disconnect the 4 wires that lead to the CRT (The X- and Y-deflection plates): this action must be done carefully to avoid damage to the side connections of the CRT. For correct reinstallation refer to the wiring diagram in chapter 4.2.
- Pull the graticule lamp holder out of the front rubber.
- Remove the bezel and contrast filter.
- Unplug the trace rotation cable (3 wires) at the connector board.

WARNING: The E.H.T. cable is directly connected to the E.H.T. multiplier that is present on the power supply. When the E.H.T. cable is disconnected from the CRT, the cable must be discharged by shorting it to the instrument's ground (e.g. the CRT screen).

- Unlock the EHT cable and discharge it to ground potential.
- Push the two plastic clamping lips that secure the CRT support to the chassis and gently lift the CRT including its shield out of the oscilloscope.

8.5.7 Removal of microprocessor unit A3

- Remove the screw that secures the unit to the rear panel.
- Remove the screw that secures (and grounds) the unit to the bottom chassis plate.
- Unplug the ribbon cable that leads to signal unit A1.
- If the IEEE option is installed, unplug the ribbon cable that leads to the IEEE-connector.
- Slide the unit upwards out of the instrument.

NOTE: The microprocessor unit can be measured under working conditions, by using the extension board with ordering code 5322 218 61479. On this board there is a jumper that can be removed to switch off the EHT- converter. This feature is not used when testing the microprocessor.

8.5.8 Removal of the units in the front frame (A4, A5)

The plastic front frame incorporates the Front unit A4 and the CRT controls unit A5. The frame can be removed from the chassis by bending out four clamping lips. Before doing so unlock the ribbon cable at the connector board.

Removal of Front unit A4:
- Pull the self-locking white plastic clamps.
- Remove the rotary knobs.
- Bend out the four clamping lips that secure unit A4 to the front frame and take the unit out.
- If required separate the rubber key mat from the printed circuit board.

NOTE: - *Do not allow dirt to reach the contact areas of the printed circuit board and the key mat. If dirty, contact areas may be cleaned with cleansing alcohol*
- *Small studs on the key mat position it on the printed circuit board. During installation the studs must be pressed gently into the matching holes of the circuit board. This can be done by using a small screwdriver.*
- *The key mat as delivered as a spare part is universal. It may be that the number of keys are too much for your instrument. If so, the unnessary keys must be cut off with a sharp knife.*

Removal of CRT controls unit A5:
- Remove the rotary knobs.
- Pull the two self-locking white plastic clamps.
- Take the unit out of the front frame.

8.5.9 Removal of the Power supply unit A6

WARNING: On the power supply unit there are many parts that carry dangerous high voltages. Some of these voltages remain some time after disconnecting the instrument from the mains. Therefore it is recommended to wait at least five minutes after having disconnected the instrument from the mains, before removing the printed circuit board. If working on the power supply under live condition cannot be avoided, it must be done by a qualified technician who is aware of the dangers involved.

- Disconnect the oscilloscope from the mains.
- Remove the screw that secures the unit to the chassis.
- Unplug the cables from the -2.2 kV cathode/filament (3 wires), the fan (2 wires) and the back-up voltage (2 wires).

WARNING: The E.H.T. cable is directly connected to the E.H.T. multiplier that is present on the power supply. When the E.H.T. cable is disconnected from the CRT, the cable must be discharged by shorting it to the instrument's ground (e.g. the CRT shielding).

- Unplug the +14.3 kV connector from the CRT.
- Unlock the plastic clamps (are part of the chassis) that secure the lower edges of the unit.
- Slide the unit upwards out of the instrument and unplug the mains input connector (3 thick wires).

NOTE: The power supply unit can be measured under working conditions, by using the extension board with ordering code 5322 218 61479. On this board there is a jumper that can be removed to switch off the EHT- converter. For safety reasons it is strongly recommended to use this feature. Refer to chapter 8.8 for more faultfinding hints.

8.5.10 Removal of digitizer unit A8.

- Remove the screw that secures (and grounds) the unit to the bottom chassis plate.
- Slide the unit upwards out of the instrument.
- Unplug the coaxial cables from the unit (the cables and connectors have colour coded rings to facilitate correct reinstallation).

NOTE: The IC's DARLIC (D8027) and DSP (D8069) are placed on sockets. Since these IC's have numerous pins, special tools are recommended to pull them out of their sockets. For DSP the type 821566-1 (for PLCC68) manufactured by AMP is a suitable tool. For DARLIC the type TW2068 (for pin grid array) manufactured by Terminal is suitable. Reinstallation of DARLIC requires considerable pressure; however take care that pins are not bent and that components of the other side of the printed circuit board are not damaged.

The unit can be measured under working conditions, by using the extension board with ordering code 5322 218 61479. On this board there is a jumper that can be removed to switch off the EHT-converter on the power supply A8. This feature needs not to be used when testing the digitizer.

8.6 INSTRUMENT REPACKING

If the instrument is to be shipped to a Service Centre for service or repair, attach a tag showing the full address and the name of the individual at the users firm that can be contacted. The Service Centre needs the complete instrument, its serial number and a fault description. If the original packing is not available, repack the instrument in such a way that no damage occurs during transport.

8.7 TROUBLESHOOTING TECHNIQUES

If a fault appears, the following test sequence can be used to assist in locating the defective component:

- Check to verify that the control settings of the instrument are correct. Consult the operating instructions in the Operating guide.
- Check the equipment to which the instrument is connected, and check the interconnection cables.
- Verify that the instrument is properly calibrated. If it is not, start the autocalibration procedure by pressing the CAL key for 2 seconds. If this does not solve the problem refer to Chapter 7 'Calibration Adjustment Procedure'.
- Locate the circuit(s) in which the fault is suspected: the symptom often indicates the faulty circuit. If the power supply is defective, the symptom may appear in several circuits.
- Visually check the circuit(s) in which the fault is suspected. Often it is possible to find faults such as 'cold' or defective solder joints, intermittent or open interconnection plugs and wires or damaged components.

8.8 TROUBLESHOOTING THE POWER SUPPLY

WARNING: On the power supply there are many parts that carry dangerous high voltages. Some of these voltages remain some time after disconnecting the unit from the mains. Therefore, it is recommended to wait at least five minutes after having disconnected the unit from the mains, before removing the unit. If working on the power supply unit under live condition cannot be avoided, it must be done by a qualified technician who is aware of the dangers involved. The use of an mains isolation transformer is strongly recommended.

The table below indicates the output voltages, currents and power figures delivered by the power supply. To determine whether a certain fault condition is initiated by the power supply itself or by the connected oscilloscope circuits, a dummy load is listed in the table. The table gives also an example of the resistor types that can be used to compose the dummy load. The resistors and connector (ordering number 5322 267 70308) that fits on connector X1002 can be ordered at Consumer Service.

Supply voltage	Current drain	Substitution resistance	Dissipated power	Dummy load resistors
+5 V	3000 mA	1.7 Ω	15 W	5x 10Ω/4W (4822 112 21054) in parallel
-5.2 V	1750 mA	2.9 Ω	8.7 W	3x 10Ω/4W (4822 112 21054) in parallel
+12 V	1750 mA	6.8 Ω	21 W	3x 22Ω/7W (4822 112 41063) in parallel
-12 V	1450 mA	8.3 Ω	17.4 W	3x 27Ω/7W (4822 112 41065) in parallel
+18 V	550 mA	32.8 Ω	10 W	3x 10Ω/4W (4822 112 21054) in series
-18 V	195 mA	92.5 Ω	3.5 W	2x 47Ω/4W (4822 112 21072) in series
+58 V	60 mA	966 Ω	12.1 W	2x 470Ω/7W (4822 112 41098) in series
-58 V	80 mA	725 Ω	4.7 W	330Ω/4W (4822 112 21094) and 390Ω/4W (4822 112 21096) in series.
+10 Vref	9 mA	1100 Ω	0.1 W	--
6.3 Vac	240 mA	26.3 Ω	1.5 W	--
-2.2 kV	700 uA	3.1 MΩ	1.55W	--
+14.5kV	50 uA	290 MΩ	0.7 W	--

Another way of fault location is the use of the extension board with ordering code 5322 218 61479. On this board there is a jumper that can be removed to switch off the EHT-converter. For safety reasons it is strongly recommended to use this feature.

The current drawn from a certain supply voltage can be measured after having removed the series choke and connecting a current meter instead of it. The chokes are L1273 (+5 V), L1201 (-5.2 V), L1202 (+12 V), L1203 (-12 V), L1204 (+18 V), L1206 (-18 V), L1208 (+58 V) and L1209 (- 58 V).

8.9 SPECIAL TOOLS

8.9.1 Extension board

For test and repair purposes the units A3 and A6 can be plugged in their connectors via an extension board. This board is available under ordering number 5322 218 61479. On this board there is a jumper that can be removed to switch off the EHT-converter. For safety reasons it is strongly recommended to use this feature.

8.9.2 Flash-ROM loader program

After calibration of the oscilloscope, the softkey 'save calibr data' must be pressed. This saves the calibration data in the oscilloscope's internal Flash-ROM's. When the oscilloscope is turned off now, calibration data does not disappear with no back-up batteries installed. The save action can be done 10 times.

The Flash-ROM's contain blocks of calibration data (of which the most recent block is valid) and the operating software. After operation of softkey 'save calibr data', the text 'XX CALIBRATION FIELDS FREE' is displayed. XX can be a figure between 10 ... 1 or 'NO'. In case of 'NO', the Flash ROM must be emptied and redundant blocks of calibration data must be removed. To have this done, send your oscilloscope to the nearest Service Center.

The data exchange takes place via the oscilloscope's RS232 interface. It occurs via a program running on a Personal Computer with RS232 interface.

The Flash-ROM's D1013 and D1015 as listed in the parts lists is empty. After echange it must be filled with operating software and calibration data. Also for this the oscilloscope must be sent to the nearest Service Center.

8.10 RECALIBRATION AFTER REPAIR

After any electrical component has been renewed the calibration of its associated circuit should be checked, as well as the calibration of other closely-related circuits.

Since the power supply affects all circuits, calibration of the entire instrument should be checked it work has been done in the power supply or if the transformer has been renewed.

8.11 TESTS BUILT INTO THE INSTRUMENT.

8.11.1 Power-up test.

After turning the oscilloscope on, power-up tests start automatically. The tests take less than a second. A message appears on the screen when errors are found. With no message displayed, the oscilloscope is ready for use. The tests that are sequentially done and the associated error messages are:

- The oscilloscope's internal control bus is checked. This is done by addressing N9001, N9002, N9003, N8005, N6014, D9009 (unit A1), N1001, N2002 (unit A2), N1141 (unit A6) and N8009, N8070 (unit A8). Error message: 'NO ACKNOWLEDGE ON I2C BUS'.
- The oscilloscope's hardware configuration is tested on the units A1, A3 and A8. On unit A1 is tested for 100 or 200 MHz and 4 or 2+2 channels. On A3 the presence of an IEEE interface and the amount of memories. Also is tested if the the software version corresponds with the hardware modification level. Error messages: 'WRONG A1 HARDWARE VERSION', 'WRONG A3 HARDWARE VERSION' or 'WRONG A8 HARDWARE VERSION'.
- The communication between the front unit A4 (named 'ufo') and microprocessor A3 is checked. Message: 'CANNOT COMMUNICATE WITH UFO'.
- The contents of the settings memory is checked if back-up batteries are installed. Message: 'NO BATTERY BACKUP'.
- Many IC's and belonging bus structures on unit A8 such as BATGE, DARLIC, CURCON, MAM and PRAM are tested. In case of an error, a message such as DARLIC ERROR, CURCON ERROR or similar is displayed.

8.11.2 Introduction to diagnostic tests.

The tests are accessible via the softkey menu's. A good knowledge of the circuitry of the oscilloscope is necessary to take advantage of these tests. Refer to chapter 5 'Unit descriptions' for additional information and circuit diagrams.

Tests can be performed on:

- The microprocessor system.
- The inputs for the microprocessor (rotaries and keys via the processor in the front unit).
- The outputs from the microprocessor (digital to analog converters and output buffers).
- The IC's and bus structures of digitizer unit A8.

The configuration of the control part under direct microprocessor influence is given in the figure. The lines SDA (Serial DAta) and SCL (Serial CLock) are fed to the many circuits, where the serial information is converted into the different control signals.

NOTE: For servicing, solder joints are added in the p.c.b. tracks. These can be used to localize a fault in the bus by means of isolating a suspected IC from SCL or SDA lines.

Proceed as follows to reach the tests:

- Press menukey 'UTIL'.
- Press softkey 'MAINTENANCE'.
- Now softkey selection is possible between 'SELFTEST' and 'REPAIR TOOLS'.

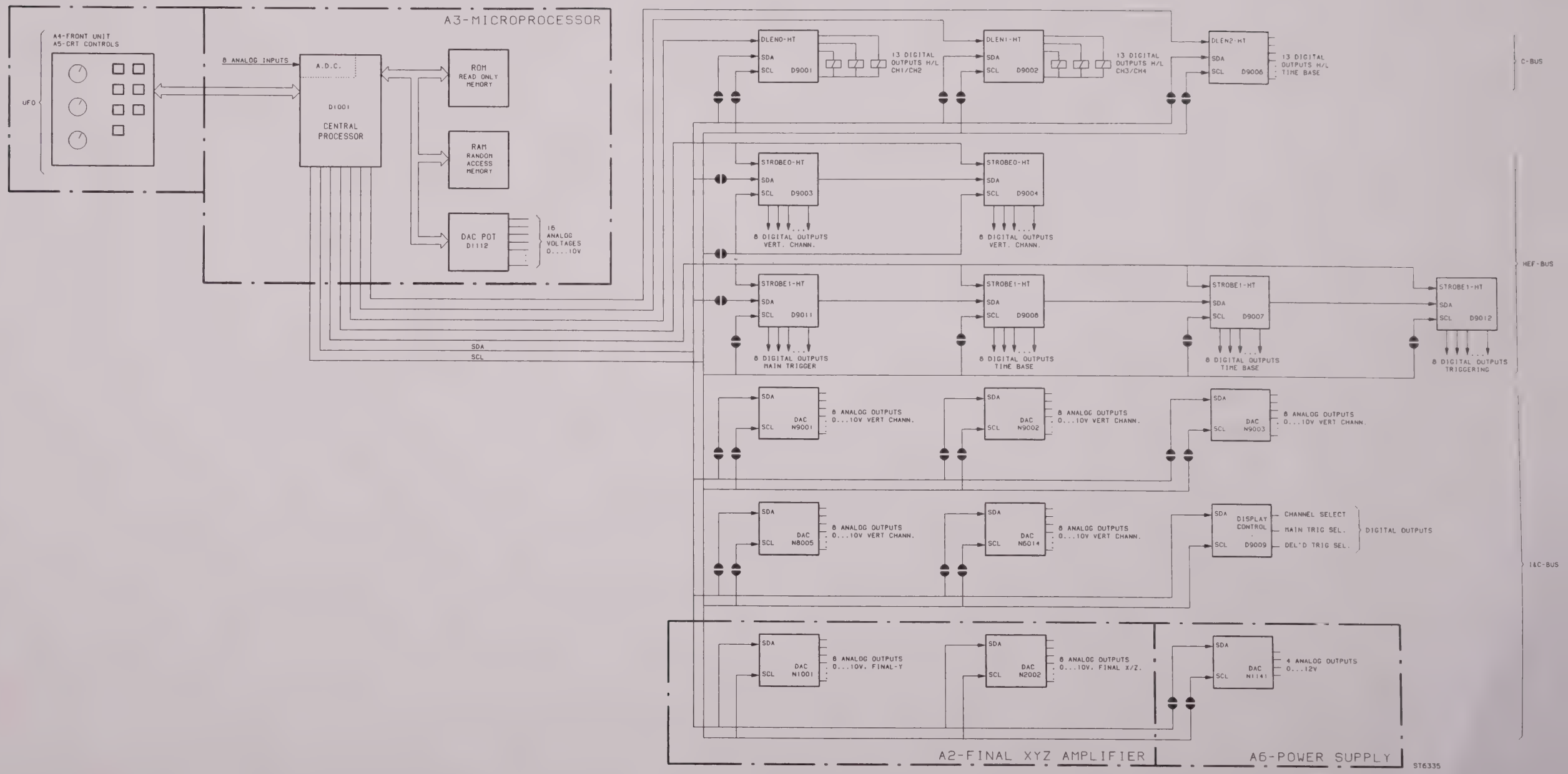


Figure 8.5 Configuration of control part under direct control of microprocessor.

8.11.3 SELFTESTS.

Under the softkey 'SELFTEST' it is possible to run tests for the microprocessor and digitizer units. With a toggle softkey, selection is possible between 'test-all' and 'specific'.

A test is started with softkey 'start'. A test that is being executed can be interrupted with softkey 'abort'. A test completed succesfully gives the screen message 'TEST PASSED'.
The selection 'test all' starts a sequence of all tests. If a fault is found, 'specific' must be selected: this gives the possibility to determine what part is defective. By means of the 'TRACK' rotary, one of the specific tests can be selected. Softkey 'RETURN' is used to move upwards in the menu structure.

The selftests mainly check the bus structures that interconnect the IC's on digitizer unit A8 and microprocessor unit A3. The tests are done with bitpatterns such as 1111 ... (FF hex), 0000 ... (00 hex), 1010 ... (AA hex) and 0101 ... (55 hex) that are 16 or 8 bits wide. It is tested for bit(s) stuck at one (+5 V), bit(s) is stuck at zero (0 V), bits interconnected or bit(s) interrupted. The message 'TEST PASSED' is displayed on the screen if a test is terminated succesfully; if not 'TEST FAILED' or an error code is displayed. The error code gives information about the kind of fault that has occurred. The tests of the random access memories (e.g. MAM, FAM, PRAM) are done for many memory locations: the message 'TEST PASSED' gives a good certainty that the chip is error free. Tests for other devices (e.g. BATGE, DARLIC, CURCON) do not test each and every aspect of the chip. The tests write bitpatterns into a certain buffer. Then the pattern is read from the buffer and checked. It must also be borne in mind that tests cannot be run if certain parts (e.g. the microprocessor on unit A3, text generator) are not functioning. The tests are initiated from the microprocessor and routed to digitizer A8 via bus lines and connector board A10.

CPURAM

This test checks the RAM (D1012) on unit A3. D1012 belongs to microprocessor D1001 on unit A3.

If completed succesfully the message 'TEST PASSED' is displayed.

In case of an error the message 'TEST FAILED' is displayed.

BATGE (Bus Arbiter and Trace GEnerator)

Main function(s) of BATGE (D8048) are arbitration between multiple processors and memories at high speed (40 MHz clock). D8048 has a connection with MAM (D8054, D8056).

During the BATGE test 4 bitpatterns are send to a testregister inside D8048. Then they are read and verified. This test does not cover every aspect of the functioning of D8048. Moreover the fact that the microprocessor address and databits 00 ... 07 are combined can give incorrect error messages.

In case of an error, the message 'TEST FAILED' is displayed. The second line of this message has five positions that give information about the kind of fault that is detected. This information is intended for factory use.

DSP (Digital Signal Processor)

Main function(s) of DSP (D8069) are Average, Envelope, Mathematical, Interpollation, Filters, Display memory refresh, X position control, Delta T processing. D8069 has a connection with the PRAM (D8049, D8052).

The DSP test checks the communication between DSP and microprocessor on unit A3. A message is sent to the DSP and this device should answer with an acknowledge. In case of an error, the message 'TEST FAILED' is displayed.

DARLIC (Data Acquisition and tRigger Logic IC)

Main function(s) of DARLIC (D8027) are data path (speed conversion, transfer from FAM to MAM) and trigger engine (start/stop acquisition, pre/posttriggering, delta-t counter, timed pattern mode).

During the DARLIC test 2 bitpatterns (FF hex and 00 hex) are send to a register inside D8027. Then they are read and verified. The test does not cover each and every aspect of the functioning of DARLIC.

In case of an error, the message 'TEST FAILED' is displayed without any further specification.

CURCON (CURsor and text CONtrol IC)

Main functions of CURCON (D8047) are generation of text and cursors. CURCON has a connection with RAM D8051.

During the CURCON test the databus is checked for stuck at 0, stuck at 1, opens and interconnections. Also the databus connection between Curcon and belonging RAM (D8051) is tested. This test does not cover each and every aspect of the functioning of D8047.

In case of an error, the message 'TEST FAILED' is displayed. The second line of this message has five positions that gives information about the kind of fault that is detected. This information is intended for factory use.

MAM (Main Acquisition Memory)

In this memory (D8054, D8056) the register contents, display information and other data are stored.

During the MAM test the global databus from BATGE to MAM is checked for stuck at 0, stuck at 1, opens and interconnections. This test does not cover each and every aspect of the functioning of D8054/56.

In case of an error, the message 'TEST FAILED' is displayed. The second line of this message has five positions that give information about the kind of fault that is detected. This information is intended for factory use.

FAM (Fast Acquisition Memory)

In this memory the signal samples from the ADC are stored. The memory consists of 8 RAM's D8037 ... D8046.

The FAM test is a databus test. In case of an error, the message 'TEST FAILED' is displayed. The second line of this message has five positions that give information about the kind of fault that is detected. This information is intended for factory use.

PRAM (PRogrAm Memory)

Serves as program memory (D8049, D8052) for the DSP (Digital Signal Processor). Has a connection with DSP.

In case of an error during the PRAM test, the message 'TEST FAILED' is displayed. The second line of this message has five positions that give information about the kind of fault that is detected. This information is intended for factory use.

ROM0, ROM1,

Flash-ROM 0 (D1013) and Flash-ROM 1 (D1015) on unit A3 belong to microprocessor D1001.
If completed succesfully the message 'TEST PASSED' and the belonging checksum are displayed.
In case of a ROM0 or ROM1 error, the oscilloscope will not function normally.

8.11.4 Repair tools.

8.11.4.1 General

Under the softkey 'REPAIR TOOLS', tests can be selected concerning the exchange of information in the area around the microprocessor and digitizer unit A8:
- Data exchange between keys/rotaries and microprocessor.
- Data exchange between microprocessor and the devices that control the oscilloscope circuits.
- Data exchange between microprocessor unit A3 and digitizer A8.

Tests can be selected with a softkey pair. A test can be activated with toggle softkey 'on off'. Data in connection with the tests is displayed in the viewing area as two lines of information. The last setting is present in the utmost right position of the lowest of the two lines.

8.11.4.2 Repair tools / ufo.

With this test the proper functioning of the keys and rotaries at the front panel (ufo) can be tested. Each control has its own number. There is also information given concerning the position occupied by the controls. The tables below indicate the information from controls towards microprocessor. This is separately listed for rotaries and keys.

Rotaries (L is rotation left to right, R is rotation right to left, X indicates the rotation speed):

ILLUM	L/R0X	INTENS TEXT	L/R1X	INTENS TRACE	L/R2X
POS CH2	L/R3X	DELAY	L/R4X	HOLD OFF	L/R5X
POS CH4	L/R6X	TRIGGER LEVEL	L/R7X	FOCUS	L/R8X
FOCUS	L/R8X	TRACE ROT	L/R9X	TRACK	L/RAX
POS CH1	L/RBX	Δ	L/RCX	TRIGGER POS	L/RDX
POS CH3	L/REX	X POS	L/RFX		

Keys (A = autorepeat, M = more than 1 key pressed, X=P is function off, X=U is function on):

CAL	X00	AUTOSET	X01	DSO	X20
STATUS/LOCAL	X02	Softkey 5	X03	Softkey 6	X04
TEXT OFF	X05	CH1 + CH2	X06	AC DC GND CH1	X07
UTIL	X10	SETUPS	X11	Softkey 1	X12
Softkey 4	X13	AMPL mV CH1	X14	AMPL V CH1	X15
AMPL mV CH2	X16	AMPL V CH2	X17	pin hole	X21
Softkey 2	X22	Softkey 3	X23	50 ohm CH1	X24
ON CH1	X25	50 ohm CH2	X26	ON CH2	X27
DTB s	X32	MODE	X33	BWL	X34
TRIG1	X35	INV CH2	X36	AC DC GND CH2	X37
TRIGGER	X41	CURSORS	X42	DTB ns	X43
AVERAGE	X44	TRIG2	X45	AMPL mV CH3	X46
AMPL V CH3	X47	MAGNIFY down	X51	RUN	X52
TB MODE	X53	TRIG4	X54	TRIG3	X55
50 ohm CH3	X56	ON CH3	X57	MAGNIFY up	X61
MTB s	X63	INV CH4	X64	50 ohm CH4	X65
CH3 + CH4	X66	AC DC GND CH3	X67	SINGLE	X72
MTB ns	X73	AC DC GND CH4	X74	ON CH4	X75
AMPL mV CH4	X76	AMPL V CH4	X77	ACQUIRE	X31
SAVE	X30	RECALL	X40	MEASURE	X50
MATH	X60	DISPLAY	X70	PLOT	X71

Note: the table with keys is based upon PM3394. In other oscilloscope versions (PM3382, PM3384, PM3392) some of the keys are not present or have a different function.

8.11.4.3 Repair tools / I^2C bus.

This test displays the data (SDA) that is send by the microprocessor to a number of addressable devices. Synchronization is achieved via SCL. Each data block sent by the microprocessor is preceeded by an address on which the device can respond. The characters 'A, B, C, D, E and F' represent one hexadecimal character. The devices are the ADC's mentioned under 'REPAIR TOOLS / DAC ' and DAC N1141 on power supply unit A1.

Device	Unit	Name of circuit diagram	Address	Data format
D9009	A1	Display and trigger control	36	AB CD EF
N9001	A1	Control circuits	40	AB CD
N9002	A1	Control circuits	4C	AB CD
N9003	A1	Control circuits	44	AB CD
N8005	A1	Time base logic	48	AB CD
N1001	A2	Final Y preampl. + control	46	AB CD
N2002	A2	Final X amplifier + control	4E	AB CD
N1141	A6	EHT converter + auxiliary	88	AB CD
N8070	A8	Curcon, DAC's, Z-control	42 *	AB CD
N8009	A8	Display interface	44 *	AB CD

*) The DAC's on digitizer unit A8 are directly controlled by DARLIC (D8027).

8.11.4.4 Repair tools / adc.

This test displays the decimal representation of the input voltage applied to the analog inputs ACH0 ... ACH7 of the microprocessor D1001. The readout consists of two lines of information.

The first line displays in sequence the analog inputs:
- ACH7: the NTC-resistor R1009 (on unit A3) that measures the temperature inside the oscilloscope is connected to this input.
- ACH6 (PTEST-XA): the voltage value that represents the type of the probes applied to CH1 .. CH4 is applied to this input.
- ACH5 (TBSMART): the voltage value representing the state of a number of time base circuits is applied here. TBSMART originates from unit A1 and is applied to unit A3.
- ACH4: the applied voltage is used as a reference and derived from reference voltage +5VREF via voltage divider R1003/R1004 (unit A3).

The second line displays in sequence:
- ACH3: the applied voltage is 0 volt (CAL ground). Decimal value approx. 0.
- ACH2 (XCAL): the applied voltage originates from the measuring circuit of the horizontal output on unit A2. This is used for automatic calibration of he horizontal section.
- ACH1 (YCAL): the applied voltage originates from the measuring circuit of the vertical output on unit A2. This is used for automatic calibration of he vertical section.
- ACH0: the applied voltage is 0 volt (CAL ground). Decimal value approx. 0.

8.11.4.5 Repair tools / hef.

To control simple on/off functions there are 7 buffers (of the type HEF4094) on unit A1: this structure is called the 'HEF-bus'. Each buffer has 8 outputs as shown in the figure. The buffers are divided into 2 groups: group 0 consists of 2 buffers and group 1 consists of 5 buffers. A group can be regarded as a shift register of 16 or 40 bits. Each group of buffers has its common enable signal: STROBE0-HT or STROBE1-HT.

The test makes the data (SDA) visible that is shifted by the microprocessor into the shift register. Data is displayed in the viewing area as two lines of information. The last data block is present in the utmost right position of the lowest of the two lines. Synchronization is achieved via SCL.

The configuration of group 0 and 1 is shown in the table:

Group	Enable signal	Buffers	Name of circuit diagram
0 D9004	STROBE0-HT Control circuits	D9003	Control circuits
1 D9008 D9007 D9012 D9013	STROBE1-HT Time base logic Delayed time base DTB trigger DTB trigger	D9011	MTB trigger

The data representation for group 0 is '0:ABCD'. Each character represents the hexadecimal (16 possible states) information for 4 outputs (total 16 outputs):
- Character 'A' represents the information for D9004 outputs 14, 13, 12, 11.
- Character 'B' represents the information for D9004 outputs 4, 5, 6, 7.
- Character 'C' represents the information for D9003 outputs 14, 13, 12, 11.
- Character 'D' represents the information for D9003 outputs 4, 5, 6, 7.

The data representation for group 1 is '1:ABCD 1:EFGH'. Each character represents the hexadecimal (16 possible states) information for 4 outputs (total 32 outputs):
- Character 'A' represents the information for D9012 outputs 14, 13, 12, 11.
- Character 'B' represents the information for D9012 outputs 4, 5, 6, 7.
- Character 'C' represents the information for D9007 outputs 14, 13, 12, 11.
- Character 'D' represents the information for D9007 outputs 4, 5, 6, 7.
- Character 'E represents the information for D9008 outputs 14, 13, 12, 11.
- Character 'F' represents the information for D9008 outputs 4, 5, 6, 7.
- Character 'G' represents the information for D9011 outputs 14, 13, 12, 11.
- Character 'H' represents the information for D9011 outputs 4, 5, 6, 7.

Note: The data for D9013 is not displayed. This buffer is only used when turning-on the oscilloscope: it tests if hardware and software belong to each other.

There also exists a HEF-bus on digitizer unit A8. This bus consists of D8034, D8036, D8033 and D8032 and is directly controlled by DARLIC (D8027). The data applied to this bus cannot be displayed on the CRT screen.

8.11.4.6 Repair tools / cbus.

To control on/off functions in the CH1 ... CH4 attenuators and in the main and delayed time base, there are 3 buffers on unit A1 of the instrument. This configuration is called the 'c-bus'. Each buffer has 13 outputs and can be regarded as a shift register of 13 bits. Each buffer has its own enable signal. The test makes the data (SDA) visible that is shifted by the microprocessor into the buffer. Synchronization is achieved via SCL.

The configuration is shown in the table:

Enable signal	Buffer	Name of circuit diagram
DLEN0-HT	D9001	Control circuits
DLEN1-HT	D9002	Control circuits
DLEN2-HT	D9006	Main time base

The data representation for D9006 is '0:ABCD'. Each character represents the hexadecimal (16 possible states) information for 4 outputs. The data representation for D9001 and D9002 is more complex: these buffers drive the pulse relays in the CH1 ... CH4 attenuators. Changing an attenuator setting can cause the generation of several '0:ABCD' blocks of data. Refer to chapter 5.1.1 for information on how the pulse relays are controlled. D9001 controls CH1 and CH2: data blocks have the configuration '0:ABCD'. D9002 controls CH3 and CH4: data blocks have the configuration '1:ABCD'.

8.11.4.7 Repair tools / DAC.

Thoughout the oscilloscope there are several digital-to-analog converters (DAC's) that are controlled by the microprocessor. The 'REPAIR TOOLS' menu enables to select a certain DAC output (via TRACK) and to determine the output voltage (via Δ) at this output. After having opened the instrument, the voltage can be measured with a voltmeter or oscilloscope. The DAC output voltage range is between 0 ... 10V (1 ... 4V for D1112 and D8006). This test is not influenced by softkey 'on off'. A DAC VALUE once changed returns to the old value if the menu is left.
The selections with the TRACK rotary have the configuration X.Y. The character X points to a certain DAC IC. The table shows the relation:

X-value	IC reference number	Unit number	Name of circuit diagram
0.Y	N9001	A1	Control circuits
2.Y	N9003	A1	Control circuits
3.Y	N1001	A2	Final Y preampl. + control
4.Y	N8005	A1	Time base logic
6.Y	N9002	A1	Control circuits
7.Y	N2002	A2	Final X amplifier + control
8.Y	D1112	A3	Potentiometer DAC + IEEE
d1.Y	N8070	A8	Curcon, DAC's, Z-control
d2.Y	N8009	A8	Display interface
d8.Y	D8006	A8	Reference + adjustment

The character Y points to a certain output within the selected DAC IC. The table shows this for N9001, N9002, N9003 and N8005 on unit A1:

Y-value	Pin number	Name of generated signal: N9001	N9002	N9003	N8005
X.0	11	PA1OFFSTRG	AT3LFCAL	DLDOFFSET	TBINTTRAT-XA
X.1	13	PA1OFFSET	AT3OFFSET	PA4OFFSTRG	DTBVAR
X.2	14	AT1LFCAL	AT3LOOPCAL	PA4OFFSET	DSOCALD
X.3	15	AT1OFFSET	PA2OFFSTRG	AT4LFCAL	DSOCALM
X.4	16	AT1LOOPCAL	PA2OFFSET	AT4OFFSET	DTRSEN
X.5	17	ATCAL0	AT2LFCAL	AT4LOOPCAL	MTRTVMODE
X.6	18	ATCAL1	AT2OFFSET	PA3OFFSTRG	MTRBAL
X.7	20	ATCAL2	AT2LOOPCAL	PA3OFFSET	MTRSEN

Note: for explanation of signal names, refer to chapter 5.1.2

For N1001 and N2002 (unit A2) refer to the table below:

Y-value	Pin number	Name/function of generated signal: N1001	N2002
X.0	11	LF sq. wave	ASTDR
X.1	13	LF sq. wave	DARK
X.2	14	Gain	XHFADJ
X.3	15	HF sq. wave	XTRAGC
X.4	16	Offset	XCRTGCL
X.5	17	Offset	XCRTGCH
X.6	18	MF sq. wave	XCRTOFL
X.7	20	MF sq. wave	XCRTOFH

Note: for explanation of signal names, refer to chapter 5.2.2

For N8070 and N8009 on unit A8 a separate table is not given. The relation between pin number and Y-value is indentical to those given in the tables for the units A1 and A2. The main function of N8070 is intensity control on the digitizer. N8009 controls the gain and offset of the output stage of the digitizer.

For D1112 (unit A3) and D8006 (unit A8) refer to the table below:

Y-value	Pin number	Pin name D1112	D8006
X.7	16	POS CH1	OFFSET ADC A
X.4	19	POS CH2	HF SQ WAVE ADJ CH2
X.2	21	POS CH3	HF SQ WAVE ADJ CH4
X.8	13	POS CH4	OFFSET COMPASS CH1
X.1	22	VAR CH1	NOT USED
X.3	20	VAR CH2	HF SQ WAVE ADJ CH3
X.5	18	VAR CH3	HF SQ WAVE ADJ CH1
X.6	17	VAR CH4	OFFSET COMPASS CH3
X.12	9	VAR MTB	GAIN MASPU A
X.11	10	LEVEL MTB	OFFSET CH 1 AND 3
X.10	11	LEVEL DTB	OFFSET COMPASS CH2
X.15	6	INTENS TEXT	OFFSET ADC B
X.9	12	TRACE SEP	OFFSET COMPASS CH4
X.0	23	FOCUS-DA	NOT USED
X.14	7	HOLD OFF	GAIN MASPU B
X.13	8	INTENS TRACE	OFFSET CH 2 AND 4

IMPORTANT: After having completed these tests, it is recommended to reset the oscilloscope. Therefore press the keys 'STATUS' and 'TEXT OFF' simultaneously.

9 SAFETY INSPECTION AND TESTS AFTER REPAIR AND MAINTENANCE IN THE PRIMARY CIRCUIT

9.1 GENERAL DIRECTIONS

- Take care that the creepage distances and clearances have not been reduced.
- Before soldering, bend the wires through the holes of the solder leads, or wrap the wires around the leads in the form of an open U, or, maintain wiring ridigity by cable clamps or cable lacing.
- Replace all insulating guards and plates after performing all repairs.

9.2 SAFETY COMPONENTS

For safety reasons, components in the primary circuit may only be replaced by components indicated in the replaceable parts list.

9.3 CHECKING PROTECTIVE GROUND

The correct connection and condition is checked by visual control and by measuring the resistance between the protective ground connection at the plug and the cabinet/frame. The resistance shall not be more than 0.5 Ω, test current 25A. During measurement the line cable should be removed from line power. Resistance variations indicate a defect.

9.4 CHECKING INSULATION RESISTANCE

Measure the insulation resistance at U = 500 V dc between the line connections and the protective ground connections. For this purpose, set the mains switch to ON. The insulation resistance shall not be less than 2 MΩ.

NOTE: The insulation resistance of 2 MΩ is a minimum requirement at 40 °C and 95% relative humidity. Under normal conditions the insulation resistance should be much higher (10 ... 20 MΩ).

9.5 CHECKING LEAKAGE CURRENT

The leakage current shall be measured between each pole of the line power supply in turn, and all accessible conductive parts connected together (including the measuring ground terminal).
The leakage current is not excessive if the measured currents from the mentioned parts is ≤ 0.5 mA rms (without filter capacitor) or ≤ 3.5 mA rms (with filter capacitor).

9.6 VOLTAGE TEST

The instrument shall withstand, without electrical breakdown, the application of a test voltage between the supply circuit and accessible conductive parts that are likely to become energized. The test potential shall be 1500 V rms or dc equivalent at supply-circuit frequency, applied for one second. The test shall be conducted when the instrument is fully assembled, and with the primary switch in the ON position.
During the test, both sides of the primary circuit of the instrument are connected together and to one terminal of the voltage test equipment; the other voltage test equipment terminal is connected to the accessible conductive parts.

Office Products ©
Brea, California 92821

Economy View Binder 1.5"

Black #77711 05725
White #77711 05726

www.Avery.com

Product of US Origin with Foreign Components

www.manualsplus.com
1016183